

Best-Ever Woodworking Projects & Shop Tips

Updated
for 2015

2015

32 Can-Do Plans

- Bookcases & Benches
- Shelves & Storage
- Small Gifts
- Shop Jigs & more

141
Time-Saving
Tips

No-Fuss Finishing Secrets p. 29

**Heirloom Classic
Cedar Chest**
Build it with
only basic tools!

p. 12



From the Editors of
WOOD Magazine



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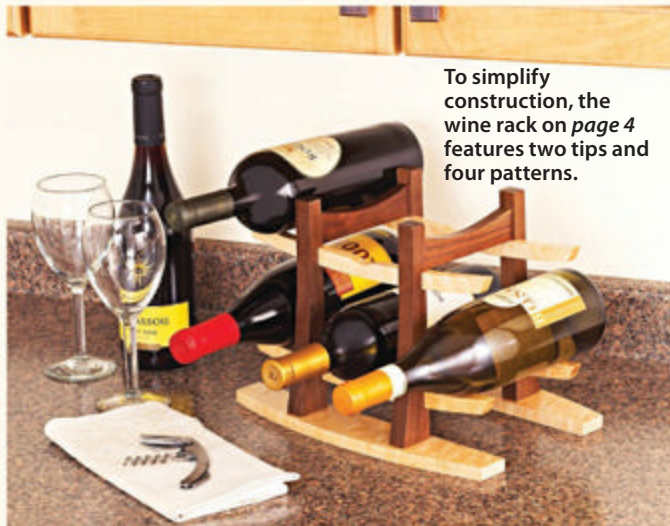
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15W104P



To simplify construction, the wine rack on page 4 features two tips and four patterns.

Great projects, great tips: Keep 'em coming

Today, there's no shortage of woodworking plans to choose from. But what is in short supply are *shop-tested* project plans. At **WOOD®** magazine, we know what woodworkers expect in plans: verified dimensions, triple-checked step-by-step instructions, and complete and accurate Materials Lists and Cutting Diagrams.

To ensure success in your shop, our staff builds every how-to project in the **WOOD** shop, located just a few steps from our offices. In this publication, we've also highlighted shop tips—141, to be exact—so you benefit from the shop tricks we learned while building the projects and preparing the instructions.

Whenever we talk to loyal readers, they tell us over and over how much they appreciate the tips that accompany our projects. We've added more woodworking help by posting informative how-to articles and free videos at woodmagazine.com. (Individual articles have more details.)

For us, it's all about guaranteeing your success with that next woodworking project.



Dave

Dave Campbell
dave.campbell@meredith.com

Left: An end table is part of a three-table set, beginning on page 66. A link to a free plan for a simple jig to taper the legs using a tablesaw is included in the project instructions.

Better Homes and Gardens®

WOOD
MAGAZINE

Best-Ever Projects & Shop Tips

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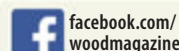
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contents

Best-Ever Projects & Shop Tips

4 **Wine Rack**

Cut only four parts and you'll be on your way to assembling a countertop wine rack.

8 **Slice-n-Dice Cutting Board**

Attractive patterns and a tough end-grain surface make this a popular gift item.



8

12 **Cedar-Lined Blanket Chest**

Building this traditional project has never been easier.

20 **Wedged-Tenon Bench**

Eye-catching through-mortises enhance a practical project for your entry.

24 **Shelves for Show**

Learn how to build this striking shelf unit that assembles easily.

29 **Easy Oak Finishing Tips**

Choose low-odor water-based stains and finishes.

30 **Pendulum Doll Cradle**

Full-size patterns help you get a solid start constructing this toy for a favorite girl.



30

36 **Easy-Does-It Garden Bench**

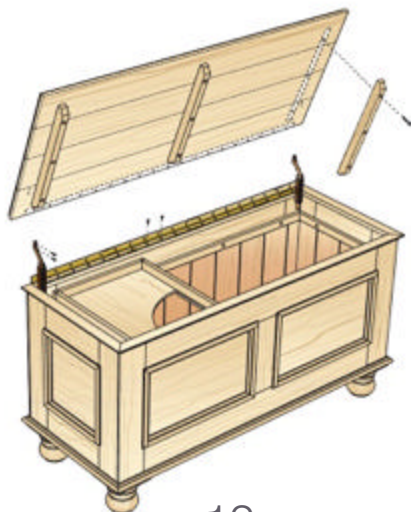
Simple lines and durable cedar add to the practicality of this outdoor project.



20



36



12



24



48



52



61



42 Build-in-a-Weekend Bookcase

Select from five different style options by changing the molding or foot profile.

48 Stack-n-Store Bins

With a tablesaw, biscuit joiner, and router, knock out these handy units in a weekend.

52 Buttoned-up Picture Frame

Build a classy Arts & Crafts-style frame accented with square pegs.

56 Shaker Clock

It's time to assemble this project with 21st-century movements and traditional styling.

61 Mobile Crane

Your kids will dig taking over the controls of this fully operational toy.

66 Three-Table Set

Change only the part dimensions to build this living-room ensemble.

73 Wine-Bottle Holder

Spotlight a special vintage with this gravity-defying table accessory.

74 Gem of a Jewelry Chest

Necklaces, bracelets, rings, and pins each have a place in this classic design.

80 Wall Shelf and Towel Rack

By using basic shop tools, you'll have this project ready in a weekend.

Special Section:

**MoreGreat
ShopTips**

85

86 Tablesaw Tips, Tricks and Techniques

92 Our Best Router Tips and Tricks

102 26 Tips for All-Around Shop Success

110 Tips for Square Corners



66



56



74

Wine Rack

Want to try your hand at mortise-and-tenon joinery? Give it a go with this manageable project.



This graceful countertop rack keeps your favorite wines at hand for dinner parties or entertaining. It has just four parts—and patterns for three of them—so you'll be able to build the rack almost as quickly as you can say *cabernet sauvignon*.

Make the frame parts first

1 Cut blanks for the legs (A) and rails (B) to size [**Materials List**, page 6].

2 Enlarge four copies each of the half-size leg, rail, and rest patterns on page 6 to 200%. Spray adhesive onto the backs of the leg and rail patterns and adhere them to the blanks for the legs (A) and rails (B).

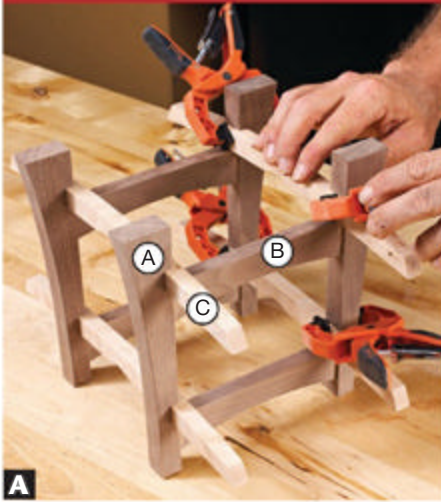
3 Form the mortises in the legs (A) and cut the tenons on the rails (B) [**Drawings 1, 1a; Shop Tip 1**].

4 Bandsaw or scrollsaw the curve on the edge of each rail blank (B). Cut

PROJECT HIGHLIGHTS

- Overall dimensions: 13" wide × 8 $\frac{5}{8}$ " deep × 8 $\frac{3}{4}$ " high.
- Materials needed: Maple, walnut. Other contrasting species, such as ash and mahogany, or white oak and padauk, could be used.
- Holds six wine bottles. See page 73 for a single-bottle holder.

GIVE IT A REST



A Stand the frames (A/B) upside down to make it easier to position the rests (C) against the bottom of the rails (B).

4 Bandsaw or scrollsaw the rests (C) to shape, cutting slightly outside the line. Then sand to the line and remove the patterns; finish-sand the rests.

5 Glue and clamp the rests (C) to the frames (A/B) [Drawing 1, Photo A].

Add the bases

1 Cut the base (D) blanks to size. Lay out the curved edge [Drawing 1] with a fairing stick by drawing a line that connects the two endpoints and the centerpoint. (For a free fairing stick plan, go to woodmagazine.com/fairing.)

2 Bandsaw or scrollsaw the edge of each base (D) slightly outside the line; then sand to the line. Finish-sand the bases to 220 grit.

3 With the rack assembly (A/B/C) upside down, center the bases side-to-side on the bottoms of the legs (A) and overhanging the backs of the legs by 1/4" [Drawing 1]. Mark screw locations centered on the legs; then drill countersunk shank holes in the bases (D) and pilot holes in the legs [Photo B]. (For #8

DRILL THE SCREW HOLES



B Drill screw holes through the base (D) into the legs (A) with a countersink bit and portable drill.

screws, drill 5/32" shank holes and 7/64" pilot holes.)

4 Glue and screw the bases (D) to the rack assembly (A/B/C).

5 After the glue dries, touch up the finish-sanding as necessary and apply three coats of clear, satin finish, sanding to 320 grit between coats. While the finish dries, raise a glass of wine to toast your success. 🍷

Written by **Larry Johnston** with **Jeff Mertz**

Project design: **Jeff Mertz**

Illustrations: **Roxanne LeMoine; Lorna Johnson**

Materials List

Part	FINISHED SIZE			Matl.	Qty.
	T	W	L		
A legs	3/4"	1 1/2"	8 1/4"	W	4
B rails	1/2"	1 1/4"	5 3/4"	W	4
C* rests	1/2"	1 1/6"	12"	M	4
D bases	1/2"	2 1/8"	13"	M	2

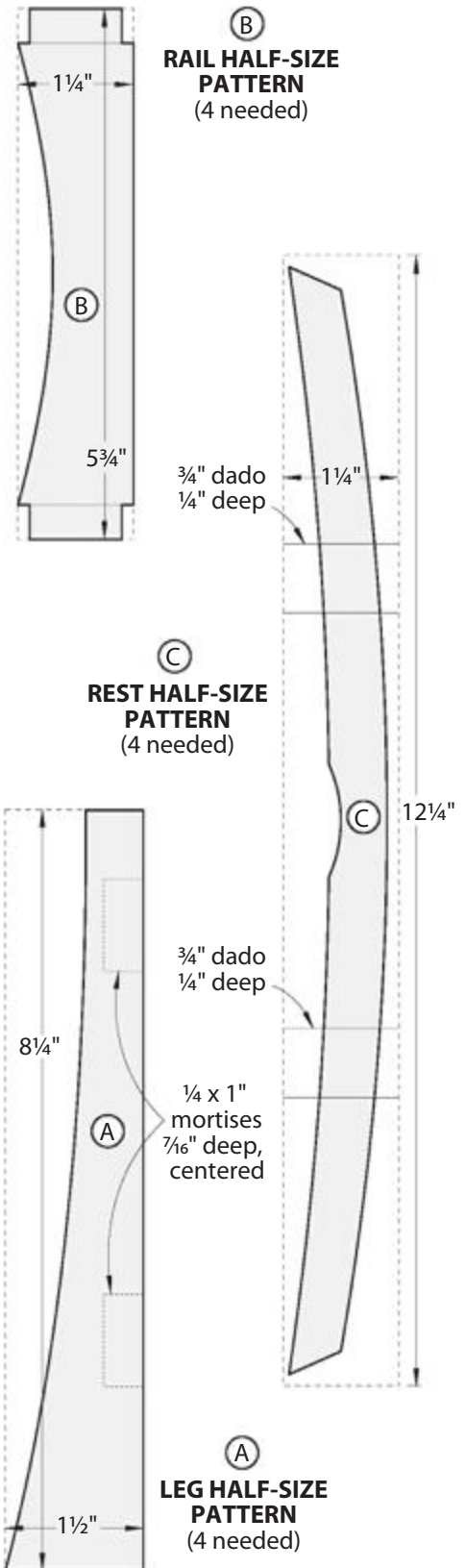
*Parts initially cut oversize. See the instructions.

Materials key: M-maple, W-walnut.

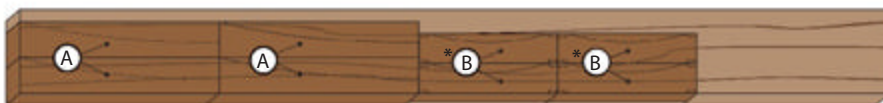
Supplies: Spray adhesive; #8x1 1/4" flathead wood screws, 3/8" self-adhesive feet (4).

Blade: Dado set.

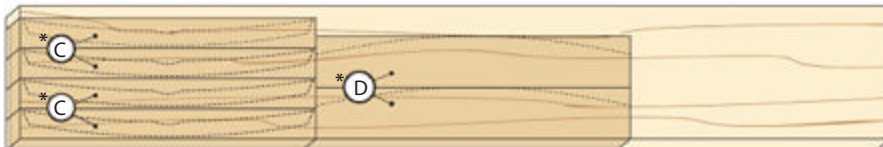
NOTE: Enlarge these half-size patterns to 200% on a photocopier to make full-size patterns for the legs (A), rails (B), and rests (C).



Cutting Diagram



3/4 x 3 1/2 x 36" Walnut (1 bd. ft.)



3/4 x 5 1/2 x 36" Maple (1.5 bd. ft.)

*Plane or resaw to the thickness listed in the Materials List.



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slice-n-dice

Cutting Board

This eye-catching kitchen accessory may look challenging, but it's amazingly easy to make thanks to a simple trick for creating the lively geometric pattern. Bonus benefit: This project provides one tough cutting surface—its end-grain top holds up well to your sharpest kitchen utensils.

In just a couple of evenings and using only a few narrow strips of maple, cherry, and walnut from your scrap bin, you can make this striking project. So rustle up some clamps and water-resistant glue, and let's get going.

Start by making a blank

1 From maple, cherry, and walnut stock between $\frac{3}{4}$ " and 1" thick, cut strips to the widths and 35 $\frac{1}{2}$ " length shown on **Drawing 1**.

SHOPTIP 3 Use up scrap. You can use scrap stock for this project with different thicknesses because you'll plane the blank to a uniform thickness after glue-up.

To ensure tight joints, prepare the strips by jointing one face and an edge and then ripping them to the needed widths.

2 Edge-glue the strips with the jointed faces down in the arrangement shown on **Drawing 1** and in **Photo A**. To keep the glue-up flat, center the clamping pressure on the blank by positioning riser blocks under the blank, as shown.

3 With the glue dry, scrape off any squeeze-out from the faces of the blank. Then plane the top face until the blank is flat and the blank has a uniform thickness. Now turn the blank over and plane it to $\frac{5}{8}$ " thick.

4 Trim the blank ends square and to a final length of 35".

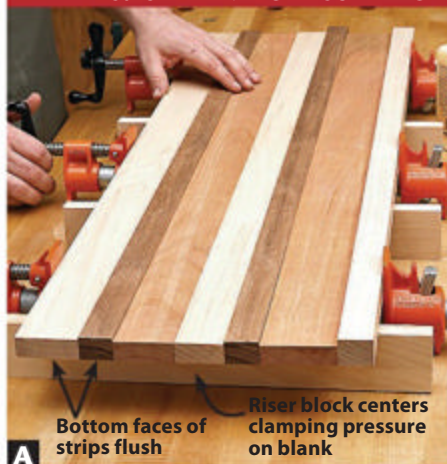
Now craft the cutting board

1 Crosscut twenty-four 1 $\frac{1}{4}$ "-wide strips from the blank, as shown in **Photo B**.

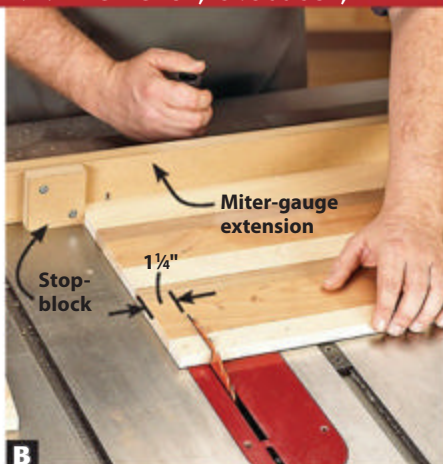
2 Align the strips on edge with the wood patterns matched. Then turn every other strip end for end to create the pattern shown on **Drawing 2**. (This also staggers the joints for a super-strong board.) To simplify the glue-up, separate the strips into three groups of eight pieces. Glue and clamp the pieces in each group together, as shown in **Photo C**.

SHOPTIP 4 Avoid glue sticking to cauls. To prevent the cauls from sticking to the cutting-board strips, place waxed paper behind the cauls and clamps.

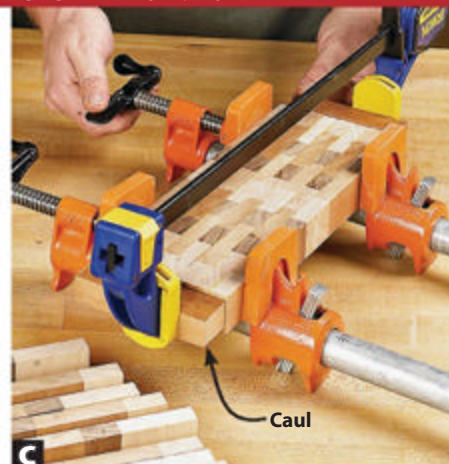
THE ABCs OF MAKING A CUTTING BOARD: EDGE-GLUE, CROSSCUT, AND FACE-GLUE THE STRIPS



A Glue and clamp the contrasting wood strips together in order, keeping the bottom faces flush. Remove the risers after clamping.



B Using a stopblock attached to a miter-gauge extension on your tablesaw, crosscut 1 1/4"-wide strips from the blank.



C Face-glue and clamp together eight strips at a time. Keep the top and bottom edges flush and the ends aligned with cauls.

After the glue dries, glue and clamp the three groups into one lamination, making sure you align them correctly to continue the pattern.

3 Scrape off all of the glue squeeze-out from the cutting board. Then, using a belt sander or a random-orbit sander with 80-grit sandpaper, sand the cutting board faces just enough to flatten them. Now finish-sand the faces with a random-orbit sander, using progressively finer sandpaper up to 180 grit.

4 Rip the long edges of the cutting board, leaving a finished width of 11". Rout 3/8" round-overs along all of the top and bottom edges and corners. Now sand the edges, ends, and round-overs to 180 grit.

SHOPTIPS 5, 6 & 7

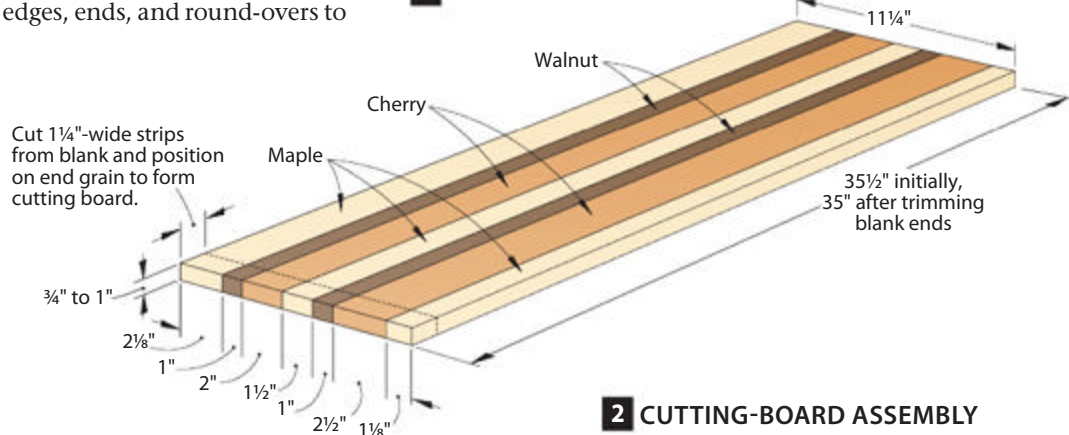
3 tips for taking care of your cutting board

- **Protect wood.** At least every three months or whenever the wood looks dry, reapply a protective penetrating food-safe finish to prevent water from soaking in and damaging the wood.
- **Hand-wash and dry.** After use, hand-wash the cutting board in warm,

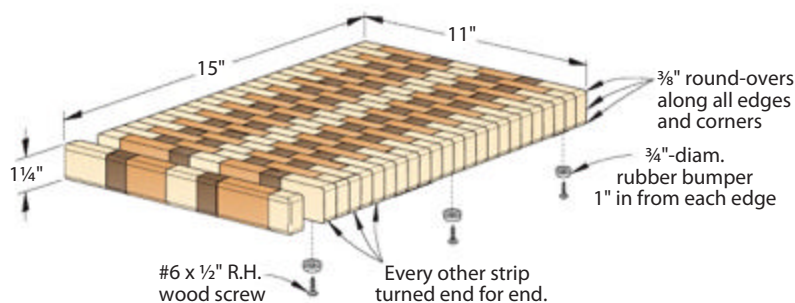
soapy water, rinse it clean, and wipe it dry. Never let the board soak in water.

- **Sand smooth.** If the cutting surface becomes heavily scored, sand it with a random-orbit sander, starting with 80-grit sandpaper and progressing to 180. Then reapply finish.

1 CUTTING-BOARD BLANK



2 CUTTING-BOARD ASSEMBLY



Find more kitchen and accessory plans at woodmagazine.com/kitchen

5 Apply a food-safe finish of your choice as recommended on the product label.

SHOPTIP 8 Food-safe finish. For a quick, inexpensive finish, we applied three coats of mineral oil, letting each coat penetrate for five minutes, and then wiped off the excess. For details, see "Is your finish food-safe?" at woodmagazine.com/foodsafefinish.

6 To prevent the board from slipping during use and to allow air underneath it for drying, drill pilot holes and screw six $\frac{3}{4}$ "-diameter rubber bumpers to its bottom, where shown on **Drawing 2**. Now gather up some fresh vegetables, and start slicing and dicing!

Simply alter the blank for fresh new looks

Here are two additional designs for you to try. To produce the patterns, combine contrasting wood strips of different widths to form the cutting-board blanks shown *below*. Make sure that the blank wood patterns—when reversed—offset all of the joint lines by at least $\frac{1}{4}$ ". Although there's no rule for the strip widths, keeping them between $\frac{1}{2}$ " and $2\frac{1}{2}$ " takes advantage of narrow scrap-bin rippings from your shop. To make either of these cutting boards, follow the instructions for this project, cutting the blank strips to the widths shown *below*.

Or if you feel adventurous, try your hand at a new design, now that you know the offset secret.

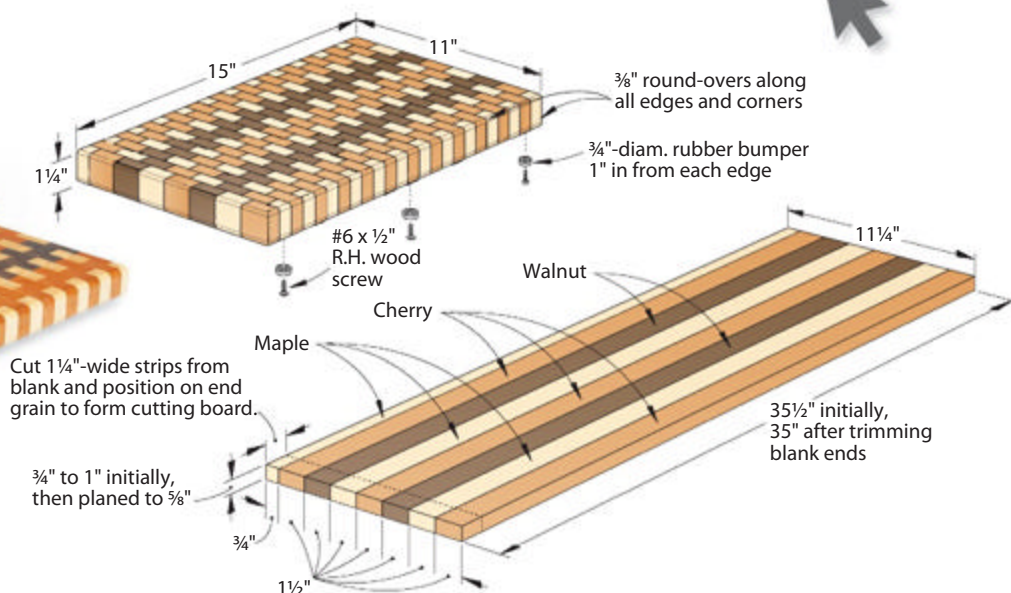
Supplies: Waxed paper, salad-bowl finish or mineral oil, $\frac{3}{4}$ " rubber bumpers with screws (6). We found the oil and bumpers at a hardware store.

Bit: $\frac{3}{8}$ " round-over router bit.

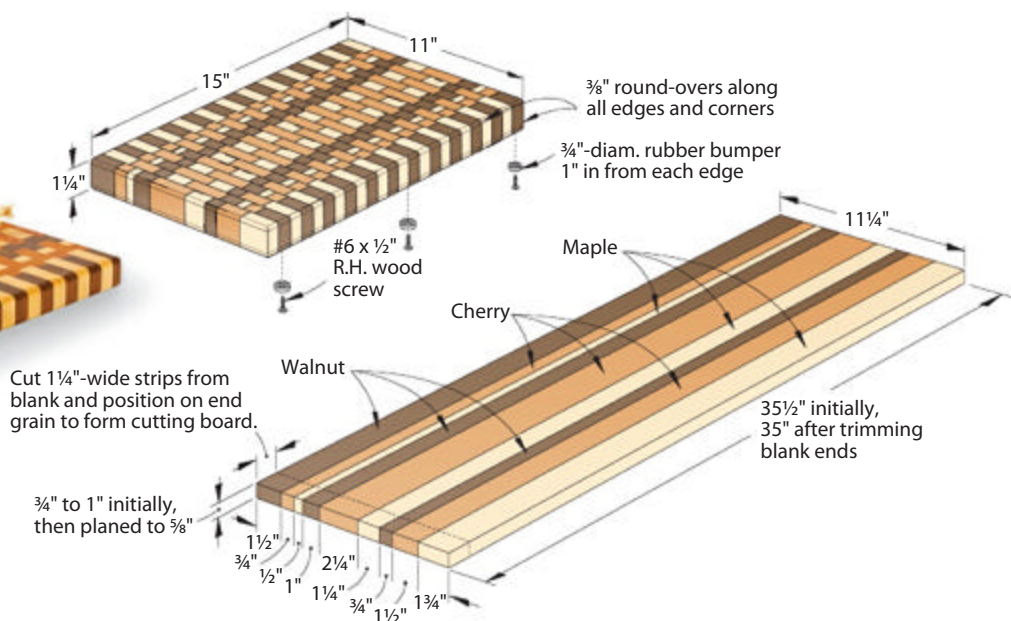
Written by **Owen Duvall**
Project design: **Jeff Mertz**
Illustrations: **Mike Mittermeier;**
Lorna Johnson

Questions about finish for this or any other woodworking project? woodmagazine.com/finishing

Design Option 1



Design Option 2



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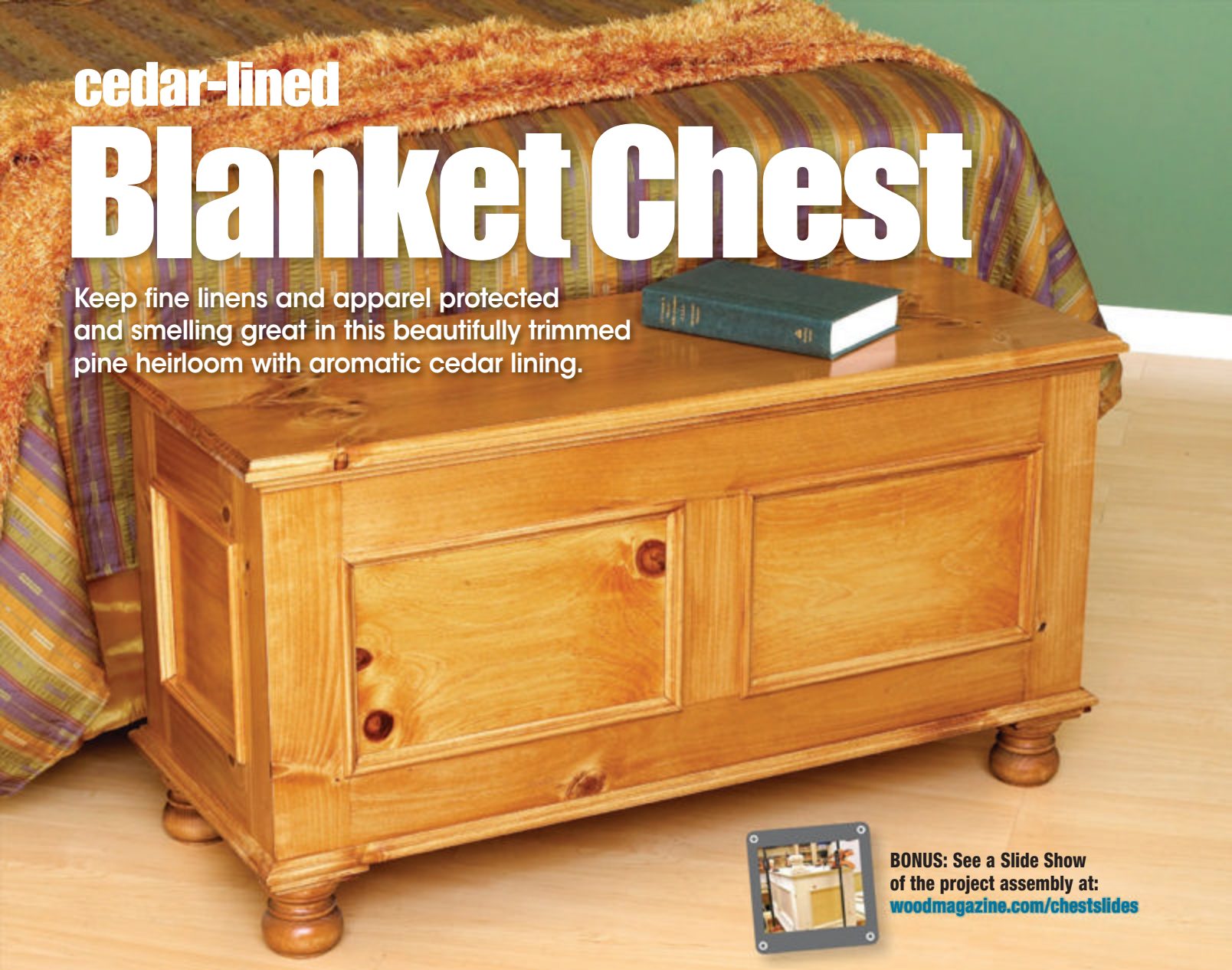
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cedar-lined

Blanket Chest

Keep fine linens and apparel protected and smelling great in this beautifully trimmed pine heirloom with aromatic cedar lining.



BONUS: See a Slide Show of the project assembly at: woodmagazine.com/chestslides

PROJECT HIGHLIGHTS

- Overall dimensions: 39¼" wide × 16¾" deep × 21⅞" high.
- Materials used: Pine, birch plywood, and cedar closet lining.
- If you wish to build the chest without the lining and tray, simply omit parts Q through W.
- The attractive trim profiles are made using common cove, round-over, and straight router bits.
- The chest front/back and side panels assemble with straightforward stub-tenon-and-groove joinery.
- Looking to save time and money? Order the hardware kit containing the continuous hinge, lid stays, and bun feet from the **Source** on page 19. Prefer to turn the feet? See the full-size pattern on page 19.

Start with the panels

1 Cut the front/back stiles (A), side stiles (B), front/back rails (C), side rails (D), and front/back center stiles (E) to the sizes listed [Materials List, page 19]. Save the rail cutoffs for making test tenons.

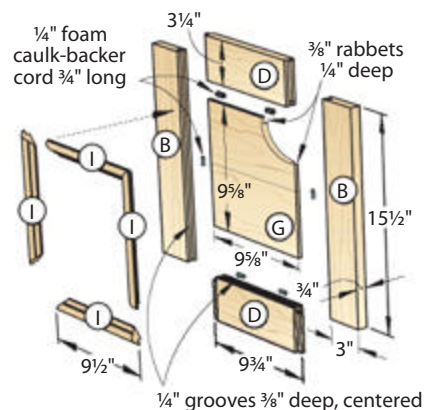
2 Using a dado blade in your tablesaw, cut a centered ¼" groove ⅜" deep along the *inside* edge of the front/back stiles (A), side stiles (B), front/back rails (C), and side rails (D), and along *both* edges of the center stiles (E) [Drawings 1 and 2].

3 Again using your dado blade set, form a ¼" tenon ⅜" long on both ends of the front/back rails (C), side rails (D), and front/back center stiles (E) [see Drawings 1 and 2, Photo A] to fit snugly in the grooves in the rails and stiles. (We cut a test tenon on a rail cutoff to verify our setup before cutting the tenons.)

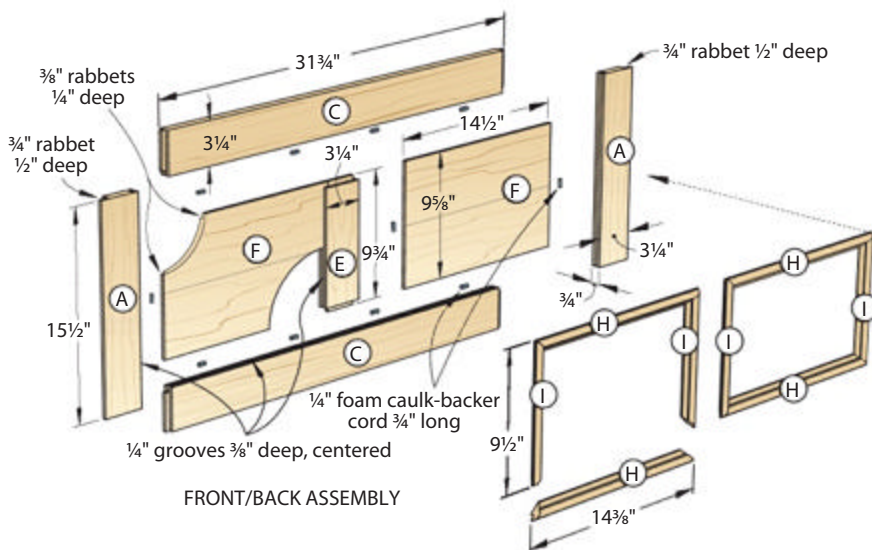


Place oft-used items in a handy tray that slides on the top lining retainers.

1 FRONT/BACK AND SIDE PANELS



SIDE ASSEMBLY



FRONT/BACK ASSEMBLY

4 Adjust your tablesaw setup. Then cut a $\frac{3}{4}$ " rabbet $\frac{1}{2}$ " deep along the *outside* edge of the front/back stiles (A) on the *inside* face to receive the side stiles (B) [Drawings 1 and 2].

5 From edge-joined stock, cut the front/back panels (F) and side panels (G) to the sizes listed. (The panels are $\frac{1}{8}$ " shorter in width and length than the openings to allow for seasonal movement.) Then cut a $\frac{3}{8}$ " rabbet $\frac{1}{4}$ " deep around each panel on the *inside* face to form a $\frac{1}{4}$ "-thick lip that fits snugly in the grooves in the rails and stiles [Drawing 1].

6 Sand all of the parts to 220 grit, and remove the dust from the panels (F, G). Stain the panels. (We applied Varathane no. 218 Traditional Pecan Stain, first applying Varathane Premium Wood Conditioner to prevent blotching of the stain on the pine.)

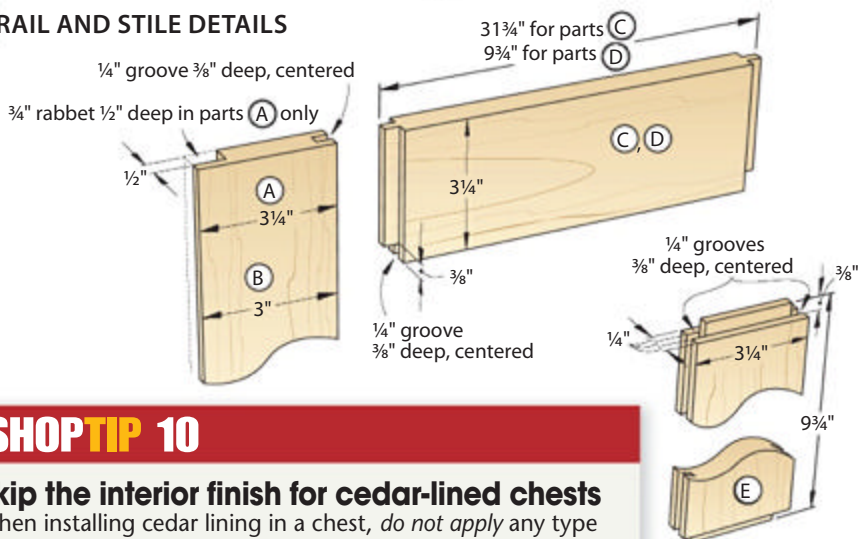
SHOPTIP 9 Stain panels first. For best results, stain panels now. Doing so prevents unfinished edges from showing when the panels contract due to seasonal movement.

If you plan to install cedar in the chest, stain only the *outside* faces of the panels, as explained *above right* in "Skip the interior finish for cedar-lined chests."

7 To assemble the front/back panels, mark centerlines on masking tape on the rails (C) and center stiles (E) on the *outside* faces for aligning the stiles. Then, to keep the front/back and side panels (F, G) centered in the openings, cut from $\frac{1}{4}$ " foam caulk-backer cord (available at home centers) 36 pieces $\frac{3}{4}$ " long for spacers.

8 Insert the foam spacers into the grooves in the front/back stiles (A), rails (C), and center stiles (E) [Drawing 1]. As shown in **Photo B**, glue and clamp

2 RAIL AND STILE DETAILS

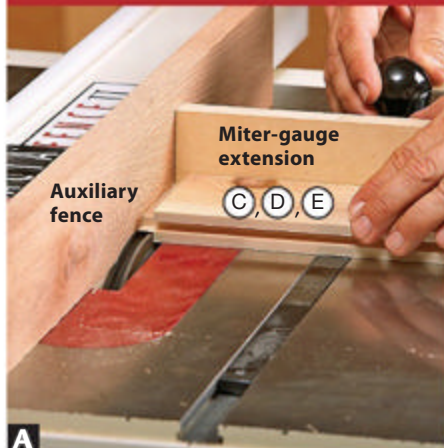


SHOPTIP 10

Skip the interior finish for cedar-lined chests

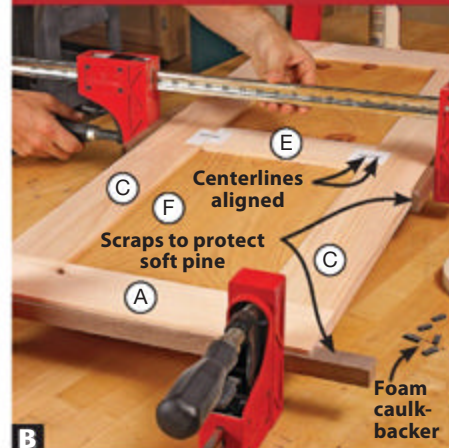
When installing cedar lining in a chest, *do not* apply any type of stain, paint, or finish to the lining, inside of the chest, bottom of the lid, tray, and lid contact surfaces. Why? The resins in cedar are similar to those in turpentine, so the vapors will soften oil- and water-based stains, paints, and finishes (including lacquer), causing clothes and the lid to stick.

CUT THE RAIL AND STILE TENONS



A Using a miter-gauge extension for backup, form a $\frac{1}{4}$ " tenon $\frac{3}{8}$ " long on each end of the rails (C, D) and center stiles (E).

ASSEMBLE THE PANELS



B Glue and clamp together the front/back stiles (A), rails (C), center stiles (E), and panels (F) with the center stiles aligned.

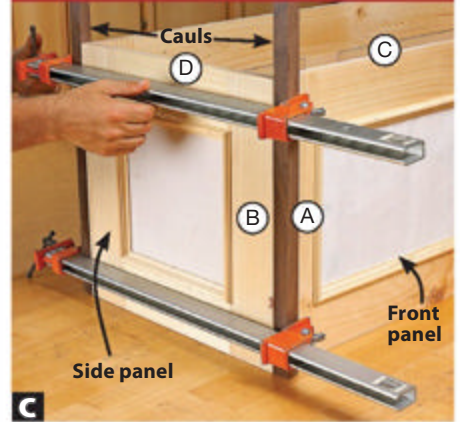
SHOPTIP 11

Protect panels from damage and stain with waxed paper

When building frame-and-panel assemblies, such as those for the blanket chest, waxed paper comes in handy for more than protecting the panels (which need to freely expand and contract) from glue squeeze-out. By leaving the paper on the prestained panels during the remaining assembly and staining of the project, the paper also protects the panels from scratches, scrapes, and additional stain. After staining, simply pull the paper out from under the panel trim (H, I).

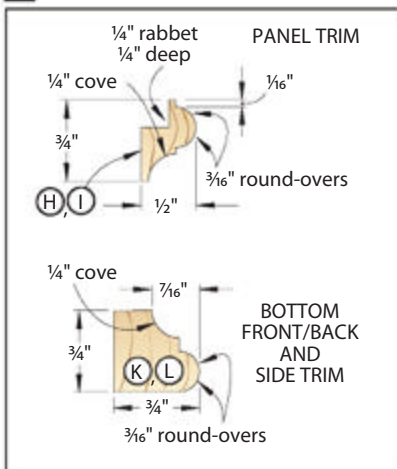


GLUE AND CLAMP THE CHEST



Apply glue in the rabbets in the front/back stiles (A), and assemble and clamp the front/back and side panels together.

3 TRIM PROFILES



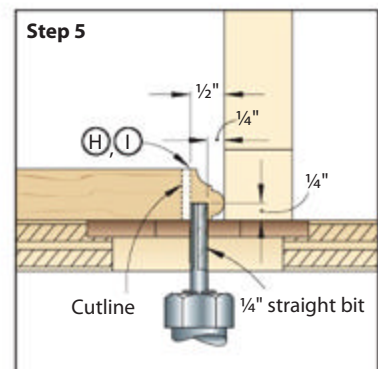
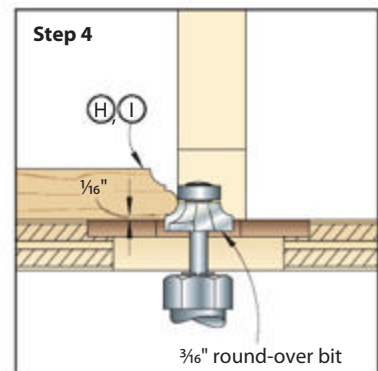
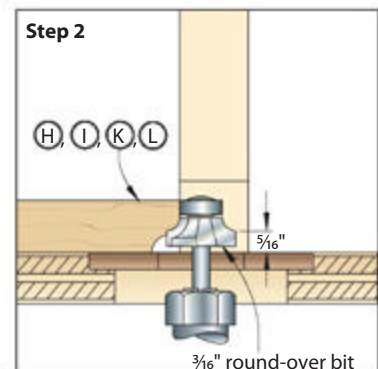
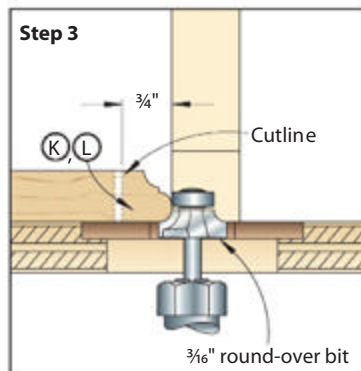
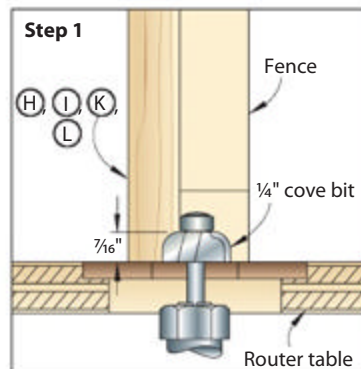
together the stiles, rails, and center stiles with panels (F) captured in the grooves and the center stile/rail centerlines aligned. Apply glue only to the rail and center-stile tenons (no glue on the panels or in the grooves).

SHOPTIP 12 Avoid dents in pine. To prevent marring the soft pine when clamping, place scrap blocks between the clamp heads and pine.

Trim and glue up the chest

1 To form the long and short panel trim (H, I), cut four 2x48" pieces from 3/4" stock. Using a 1/4" cove bit, 3/16" round-over bit, and a 1/4" straight bit, rout the profile and rabbet [Drawing 3] along both edges of each piece [Drawing 4, Steps 1, 2, 4 and 5]. Then rip a 1/2"-wide trim strip from each edge. Sand the strips.

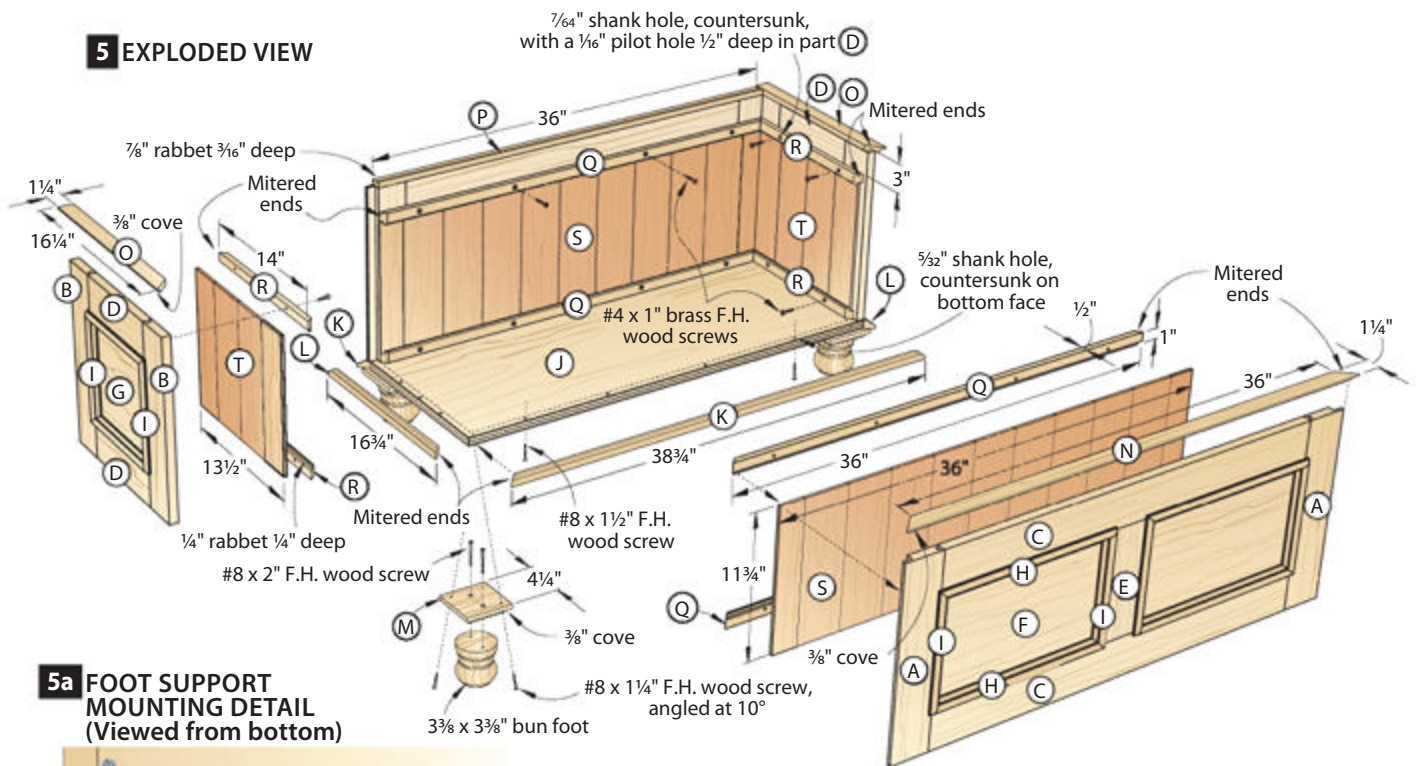
4 ROUTING THE TRIM PROFILES



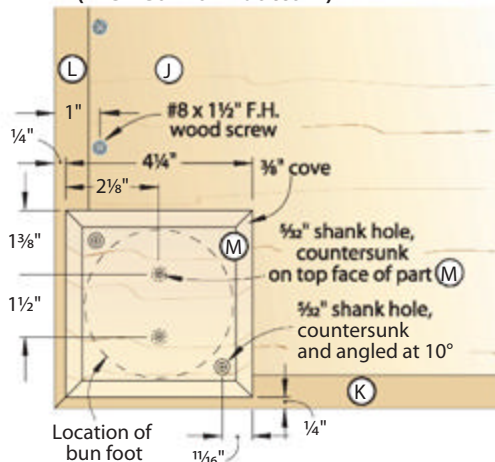
2 Miter-cut the long and short trim pieces (H, I) from the strips to fit snugly in the panel openings. To protect the panels (F, G) from glue squeeze-out when installing the trim and from additional stain when finishing the chest later, see Shop Tip 11, above. Then apply glue along the rabbet in each trim piece, and install the trim, securing it to the rails and stiles with masking tape.

3 Glue and clamp together the front/back panels (A/C/E/F/H/I) and side panels (B/D/G/I), measuring for equal diagonals to verify square [Photo C].

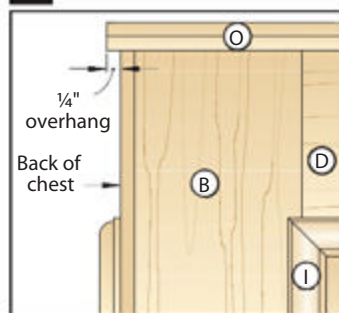
5 EXPLODED VIEW



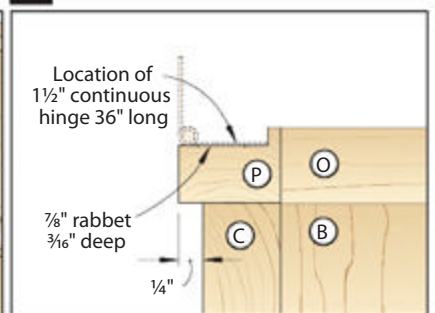
5a FOOT SUPPORT MOUNTING DETAIL (Viewed from bottom)



5b END VIEW DETAIL



5c BACK CAP TRIM SECTION DETAIL

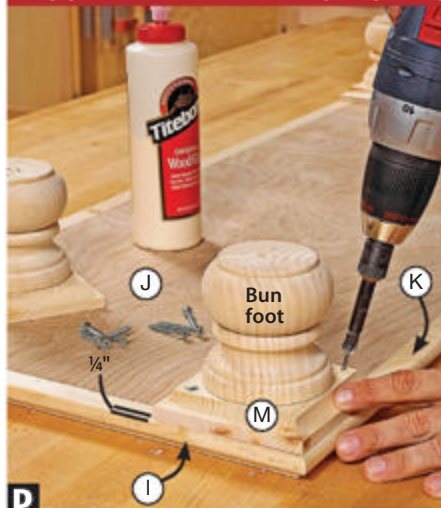


Add the bottom and feet

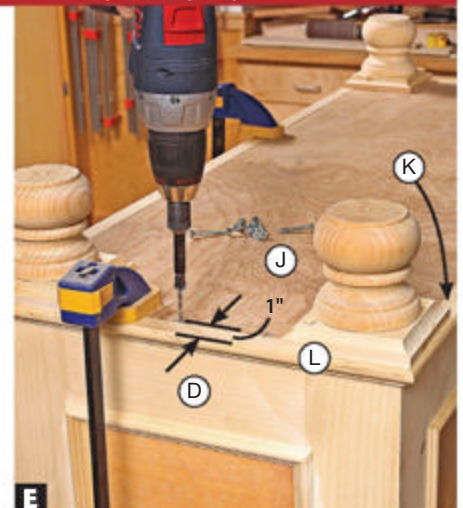
1 Cut the bottom (J) to size. Then, from $\frac{3}{4}$ " stock planed to match the thickness of the plywood bottom, cut two 2x40" pieces to form the front/back trim (K) and side trim (L). Using $\frac{3}{4}$ " cove and $\frac{3}{16}$ " round-over bits, rout the profile [Drawing 3] along both edges of one piece and one edge of the other [Drawing 4, Steps 1, 2, and 3]. Then rip a $\frac{3}{4}$ "-wide trim strip from each edge. Sand the strips. Miter-cut the trim pieces to length to fit the bottom, and glue and clamp them in place.

2 Cut the foot supports (M) to size. Then rout a $\frac{3}{8}$ " cove around the bottom edges of each support [Drawing 5]. Glue a $3\frac{3}{8} \times 3\frac{3}{8}$ " bun foot, centered, to the bottom (coved face) of each support. Now drill two mounting holes through the top of each support into the centered foot [Drawing 5a], and drive the screws.

MOUNT THE FEET AND BOTTOM ASSEMBLY TO THE CHEST



Glue each foot support (M) assembly to the bottom panel (J/K/L). Drill mounting holes angled at 10°, and drive the screws.



Drill mounting holes 1" from the outside edges of the front/back and side trim (K, L) to mount the bottom assembly to the chest.

3 With the *bottom* face of the bottom panel (J/K/L) up, glue and screw the foot support (M) assemblies to the panel, positioning the supports $\frac{1}{4}$ " from the outside edges of the front/back and side trim (K, L) [Drawing 5a, Photo D].

4 Position the chest with the bottom up. Then center the bottom panel assembly (J/K/L/M) on the chest. Drill mounting holes through the bottom (J) and centered in the front/back and side rails (C, D), where dimensioned [Drawing 5a, Photo E]. Drive the screws.

Top the chest with cap trim

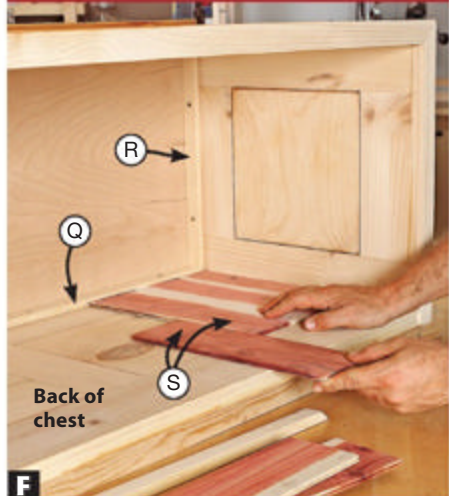
1 Cut the front and side cap trim (N, O) to the sizes listed except 2" longer in length to allow for precise fitting. Rout a $\frac{3}{8}$ " cove along an edge of each piece [Drawing 5].

2 Miter-cut one end of the front cap trim (N). Position and clamp the trim to the chest, aligning the *back* edge with the *inside* face of the top front rail (C) and the heel of the mitered end with an inside corner of the chest. Mark the heel for the miter at the other end. Miter-cut the piece. Now glue and clamp it in place.

3 Miter-cut one end of each side cap trim (O). Position and clamp the pieces to the chest, verifying tight miter joints with the front cap trim (N). Mark the finished length of the side cap trim pieces so that they overhang the back of the chest $\frac{1}{4}$ " [Drawing 5b]. Crosscut the trim at the marks. Then glue and clamp the pieces in place.

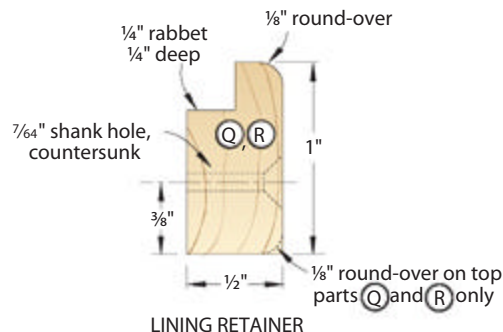
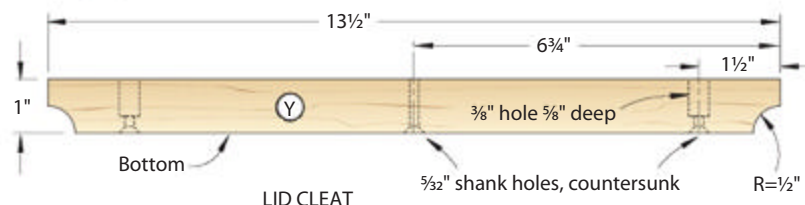
4 Cut the back cap trim (P) to size to fit snugly between the side cap trim

ADD THE AROMA

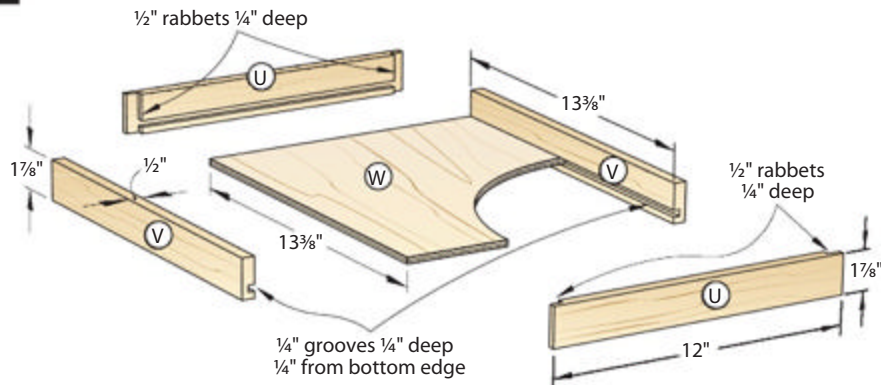


F Slide each piece of the back lining (S) into the rabbet in the bottom back lining retainer (Q), keeping the lining joints tight.

6 PARTS VIEW



7 TRAY



(O). Then cut a $\frac{7}{8}$ " rabbet $\frac{3}{16}$ " deep along the back cap trim to fit a $1\frac{1}{2}\times 36$ " continuous hinge [Drawings 5 and 5c]. Now glue and clamp the trim in place, flush with the *inside* face of the top back rail (C), in the orientation shown.

Install the cedar lining

1 From $\frac{1}{2}$ " stock, cut four 1×54 " pieces to form the front/back and side lining retainers (Q, R). Each piece yields a front or back (Q) and side (R) retainer. Cut or rout a $\frac{1}{4}$ " rabbet $\frac{1}{4}$ " deep along an edge of each piece [Drawings 5 and 6]. Then rout $\frac{1}{8}$ " round-overs along the edges of the pieces, where shown, omitting the round-over along the bottom edge of the two front/back and side pieces that you'll use for the bottom retainers.

2 Miter-cut the front/back and side retainers (Q, R) from the pieces to fit snugly in the chest. Drill mounting holes through the retainers, where shown. Sand smooth.

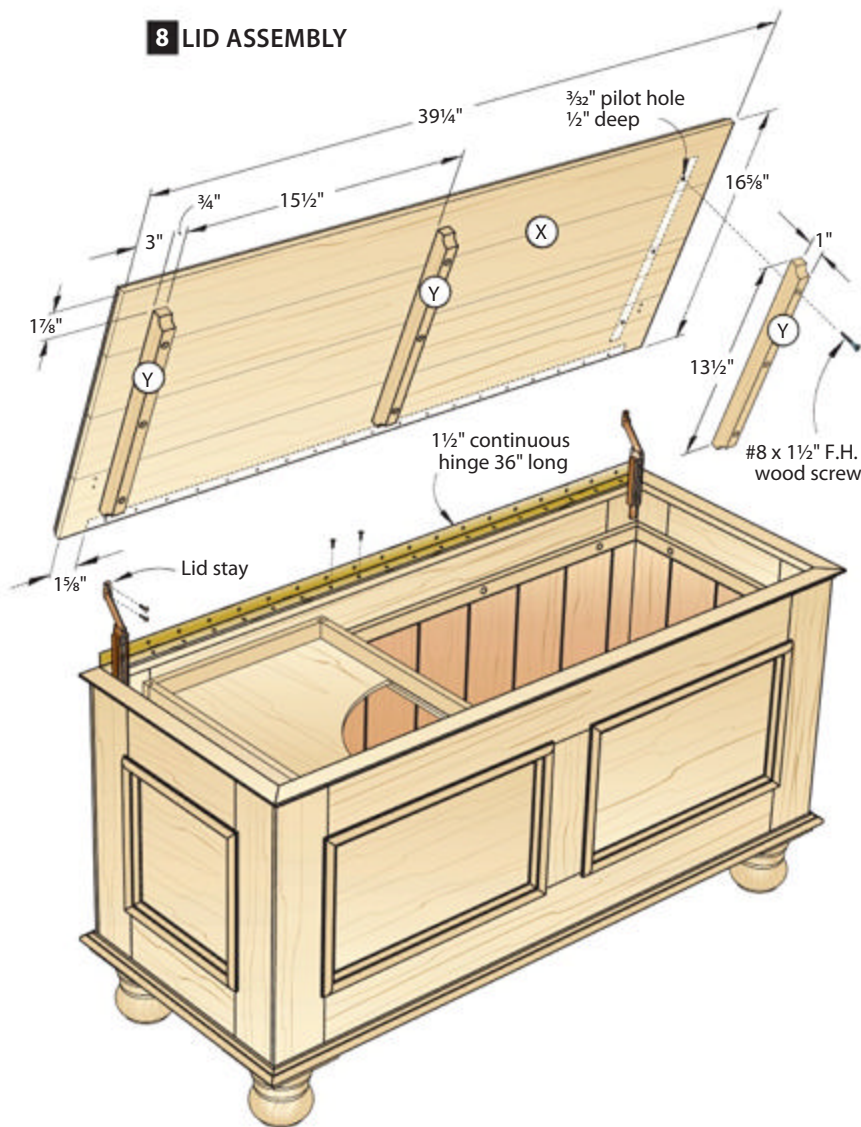
3 Position the front/back and side retainers for the bottom (the ones without round-overs on the bottom edges) in the chest. Using the mounting holes in the retainers as guides, drill pilot holes into the chest. Then drive the screws.

4 To form the front/back lining (S) and side lining (T), cut thirty $11\frac{3}{4}$ "-long pieces from $\frac{1}{4}\times 3\frac{3}{4}$ " cedar closet lining. (We found a 15-board-foot package of 48"-long lining at a local home center—enough material for the chest.)

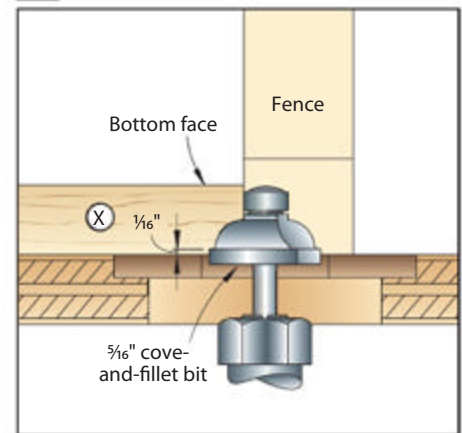
5 Lay out 11 pieces each for the front/back lining (S), and fit the tongues and grooves tightly together. Measure the length of the blanket chest interior. Center this measurement on each cedar lining assembly. Then trim equal amounts off the outside edges of the first and last pieces of each assembly. Sand the lining smooth.

6 Position the chest with the back down. Install the back lining (S)

8 LID ASSEMBLY



8a LID PROFILE DETAIL



HINGE THE LID



With the continuous hinge aligned with the marks on the lid and the hinge barrel flush with the back edge, drill the mounting holes.

[Drawing 5, Photo F]. Screw-mount the top back-lining retainer (Q) in place to secure the lining. Now reposition the chest with the front down. In the same way, install the front lining and top front retainer (Q).

7 From the remaining cedar lining pieces, lay out and fit together four pieces each for the side lining (T). Measure between the front/back lining (S) for the exact width of the side lining. As before, center the measurement on each lining assembly, and cut off the ends. Sand the lining smooth. Now install the lining and remaining side-lining retainers (R).

Build the tray

1 Cut the front/back (U), sides (V), and bottom (W) to the sizes listed.

2 Using a dado blade, cut 1/2" rabbets 1/4" deep across the ends of the front/back (U) on the inside faces [Drawing 7]. Then cut a 1/4" groove 1/4" deep 1/4" from

the bottom edges of the front/back and sides (V) to fit the plywood bottom (W). Sand smooth.

3 Glue and clamp the tray together. Measure for equal diagonals to verify square.

Time for the lid

1 Edge-join 3/4" stock to form a 17x40" blank for the lid (X). Then crosscut and rip the lid to the finished size of 16 5/8x39 1/4". Using a 5/16" cove-and-fillet router bit, rout the profile [Drawing 8a] along the ends and edges of the lid. (We used a Freud no. 38-282 router bit.) As an alternative to the cove-and-fillet profile, you can rout a 3/8" cove on the lid. Sand the lid.

2 Cut the cleats (Y) to size. Draw the radius at each end of the cleats [Drawing 6]. Bandsaw and sand to shape. Next, drill three countersunk shank holes through the cleats on the bottom

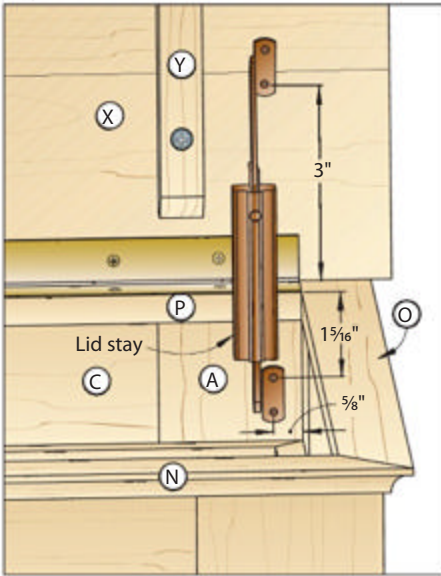
edge, where dimensioned. Now drill a 3/8" hole 5/8" deep in the outer holes (to accommodate lid movement) in the top edge.

3 With the bottom face of the lid (X) up, position (without glue) the cleats (Y), where dimensioned [Drawing 8]. Using the shank holes in the cleats as guides, drill pilot holes in the lid. Now drive the screws.

Let's wrap things up

1 Sand any areas that need it to 220 grit, and remove the dust. With the waxed paper still in place on the panels (F, G), apply wood conditioner and stain to the chest and lid. If you installed the cedar lining, do *not* stain the inside of the chest, bottom of the lid (X/Y), the top faces of the cap trim (N, O, P), and the tray (U/V/W) as explained previously. Remove the waxed paper. Then apply a finish to the stained areas only.

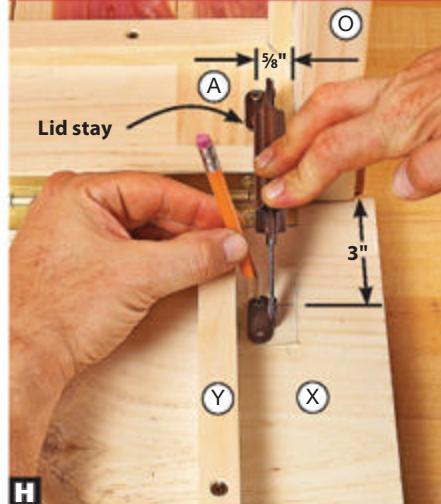
9 MOUNTING THE LID STAYS



(We applied two coats of Varathane Diamond Water-Based Polyurethane, and sanded to 320 grit between coats.)

2 To mount the lid (X/Y), position a 1½" continuous hinge 36" long in the rabbeted back cap trim (P) [Drawings 5c and 8]. Drill the mounting holes, but

MARK THE LID STAY HOLES



H Press on each lid stay to align the mounting bracket with the marked centerline on the lid (X). Mark the mounting holes.

do not drive the screws. Remove the continuous hinge.

Next, position the lid with the bottom face up. Mark alignment lines for the hinge on masking tape 1⅝" from the ends of the lid at the *back* edge. With the hinge leaves at 90°, position the hinge

on the lid, aligning the ends with the marked lines, and drill the mounting holes [Photo G]. Remove the hinge and tape. Now screw-mount the hinge to the lid and back cap trim.

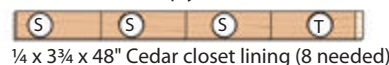
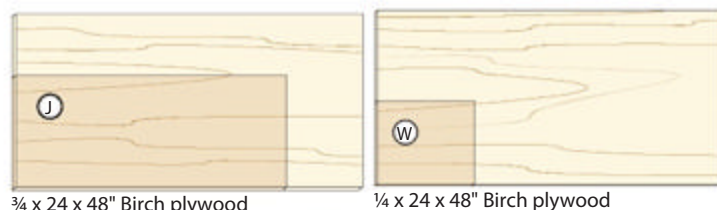
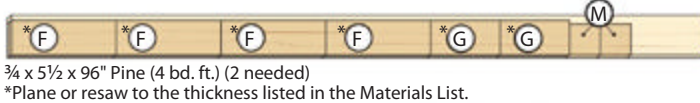
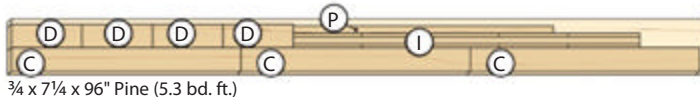
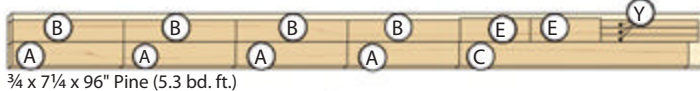
3 To mount the lid stays, position the chest on its back with the lid open at 90°. Mark centerlines for mounting holes on the chest and lid, where dimensioned [Drawing 9]. Align the appropriate mounting-bracket hole in each stay with the marked centerline on the chest, and screw-mount the stays using the supplied screws. Next, align the stays with the centerlines on the lid [Photo H], mark the mounting-bracket holes, and attach the stays. Now move the chest to the chosen location, and fill it with woolens, linens, clothes, and other items that need a protective home. 📦

Written by **Owen Duvall**

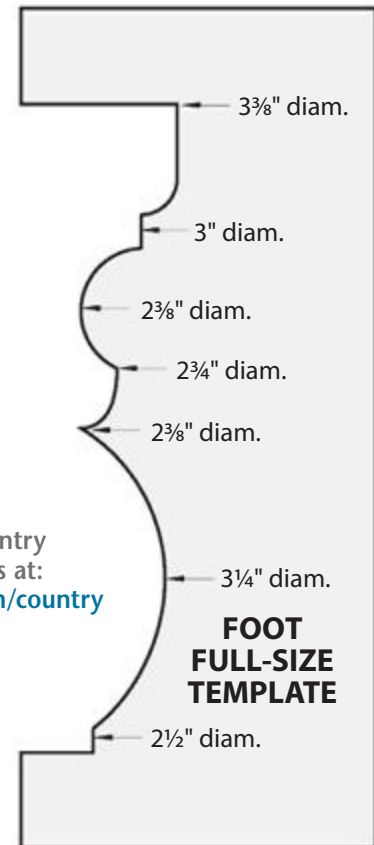
Project design: **Jeff Mertz**

Illustrations: **Roxanne LeMoine; Lorna Johnson**

Cutting Diagram



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Materials List

Part		FINISHED SIZE			Matl.	Qty.
		T	W	L		
Chest panels						
A	front/backstiles	¾"	3¼"	15½"	P	4
B	side stiles	¾"	3"	15½"	P	4
C	front/back rails	¾"	3¼"	31¾"	P	4
D	side rails	¾"	3¼"	9¾"	P	4
E	front/back center stiles	¾"	3¼"	9¾"	P	2
F	front/back panels	½"	9⅝"	14½"	EP	4
G	side panels	½"	9⅝"	9⅝"	EP	2
H*	long panel trim	½"	¾"	14⅜"	P	8
I*	short panel trim	½"	¾"	9½"	P	16
Bottom						
J	bottom	¾"	15¼"	37¼"	BP	1
K*	front/back trim	¾"	¾"	38¾"	P	2
L*	side trim	¾"	¾"	16¾"	P	2
M	foot supports	¾"	4¼"	4¼"	P	4
Cap trim						
N*	front cap trim	¾"	1¼"	38½"	P	1
O*	side cap trim	¾"	1¼"	16¼"	P	2
P	back cap trim	¾"	1"	36"	P	1
Cedar lining						
Q*	front/back lining retainers	½"	1"	36"	P	4
R*	side lining retainers	½"	1"	14"	P	4
S	front/backlining	¼"	36"	11¾"	CCL	2
T	side lining	¼"	13½"	11¾"	CCL	2
Tray						
U	front/back	½"	1⅞"	12"	P	2
V	sides	½"	1⅞"	13⅝"	P	2
W	bottom	¼"	11½"	13⅝"	BP	1
Lid assembly						
X*	lid	¾"	16⅝"	39¼"	EP	1
Y	cleats	¾"	1"	13½"	P	3

*Parts initially cut oversize. See the instructions.

Materials key: P—pine, EP—edge-joined pine, BP—birch plywood, CCL—cedar closet lining.

Supplies: ¼" foam caulk-backer cord, #8x2" flathead wood screws (8), #8x1¼" flathead wood screws (8), #8x1½" flathead wood screws (23), #4x1" brass flathead wood screws (24), 1½" continuous hinge 36" long, lid stays (1 pr.), 3⅝x3⅝" bun feet (4).

Blade and bits: Dado-blade set; ¼" and ⅜" cove, ⅜" round-over, ¼" straight, and ⅜" cove-and-fillet router bits.

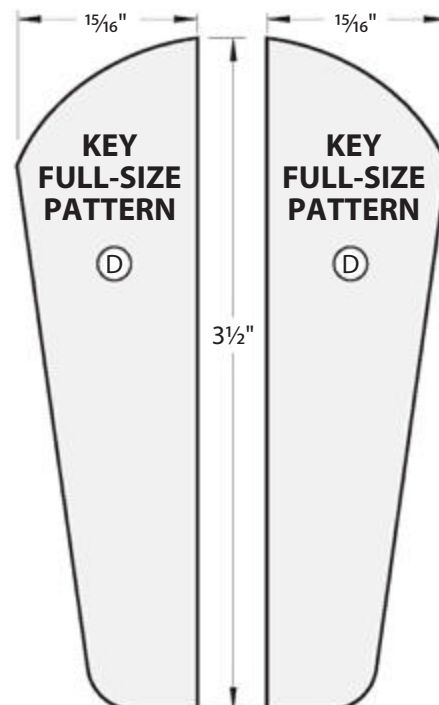
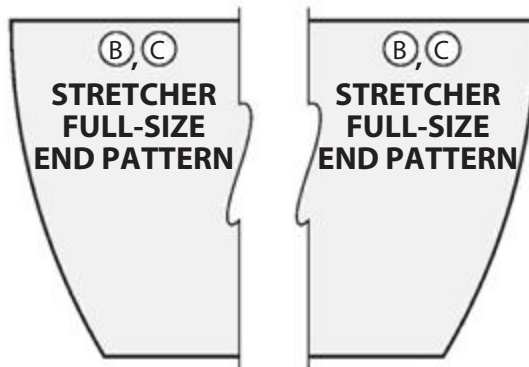
Source

Hardware kit. Contains a 1½" continuous hinge 36" long, lid stays (1 pr.), and 3⅝x3⅝" bun feet (4). Order kit no. 3017, \$69.95 plus shipping and handling. Call or click Meisel Hardware Specialties; 800-441-9870; meiselwoodhobby.com.

full-size pattern for Wedged-tenon Bench



Use the full-size patterns *below* to complete the bench project beginning on the *next page*.



sturdy & stylish wedged-tenon Bench

Make through-mortises the simple way—by using a tablesaw coupled with edge-glued parts. Later, you'll assemble the bench using eye-catching joints that feature keys and wedges in contrasting wood.



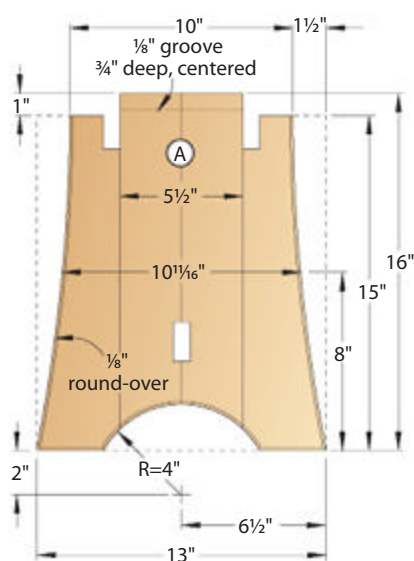
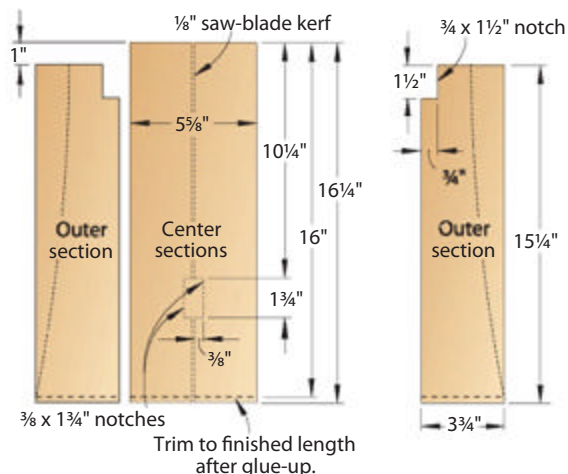
View a 12-Photo Slide Show of the Wedged-Tenon Bench coming together at woodmagazine.com/benchslides

Note: We were lucky to find a 16"-wide oak plank for the legs (A) and top (F) from which to cut the four parts for each leg and the three parts for the top. When edge-joined after machining, as noted on the *opposite* page, the grain matches perfectly, and the mortises appear to be cut into the part rather than formed by mating notches. But don't worry if you can't find a wide plank. Careful board selection will give you grain-matched parts for an equally attractive appearance.

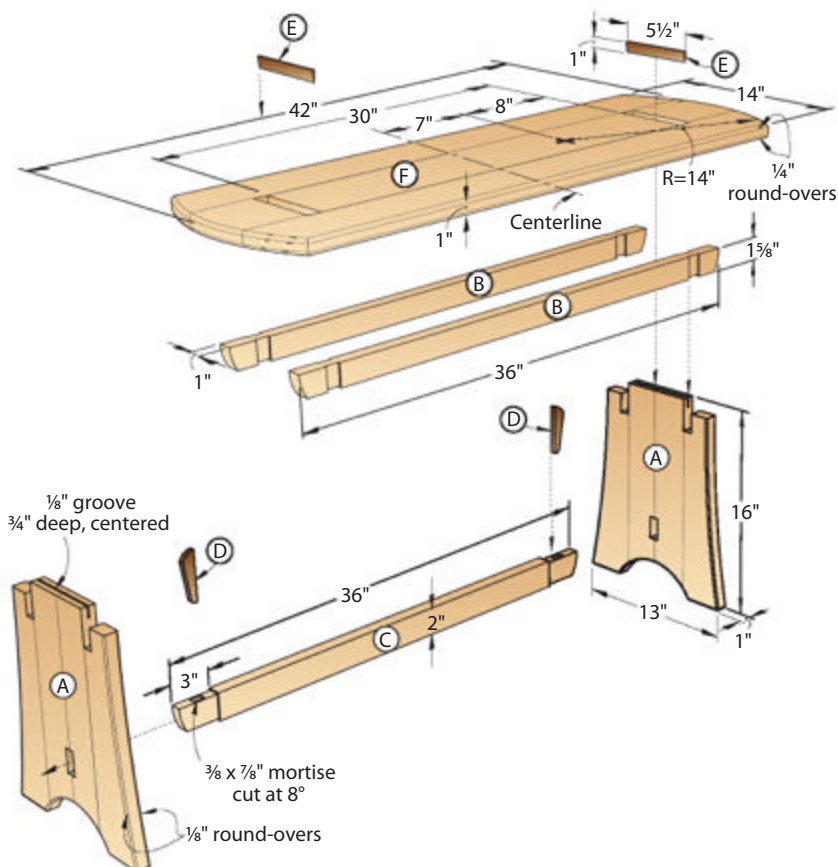
PROJECT HIGHLIGHTS

- Overall dimensions are 14" wide × 42" long × 16" high.
- The bench *above* is made from 1"-thick red oak with walnut keys and wedges.
- Learn techniques for securing tenons with keys and wedges.
- No hardware is necessary.
- For the board feet of lumber needed to build this project, see page 23.

1 END



2 EXPLODED VIEW



Begin with the legs

1 For the center sections of the legs (A), cut two 5 5/8 x 16 1/4" boards from 1" stock. Then for the outer sections of the legs, cut four 3 3/4 x 15 1/4" boards from the same stock [Drawing 1].

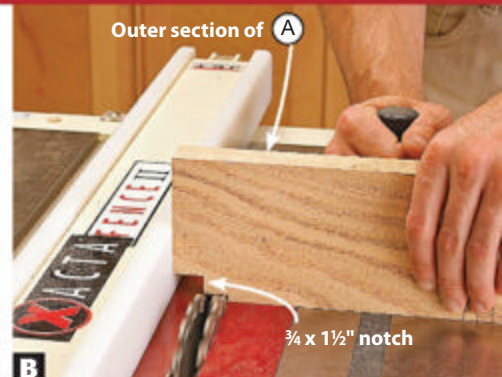
2 Rip the 5 5/8"-wide leg (A) center sections in half, using a 1/8"-kerf saw blade in your tablesaw. Then switch to a 3/4" dado blade and cut a mating notch in each half [Drawing 1 and Photo A]. Now form a notch in each leg outer section [Photo B].

3 Glue and clamp the leg (A) center sections together [Photo C]. Then with the glue dry, glue and clamp the outer sections to the center sections [Photo D]. The protruding portions of the center sections form tenons to fit into the benchtop (F) mortises [Drawing 2]. Trim the ends to the final length of 16", removing material only from the bottom edges.

EDGE-JOIN THE ENDS TO FORM PERFECT MORTISES AND NOTCHES

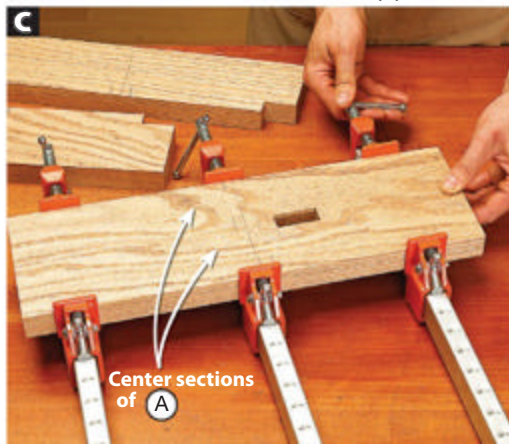


A Using the rip fence as a stop, and backing the cuts with a miter-gauge extension, form notches in the leg (A) center sections.

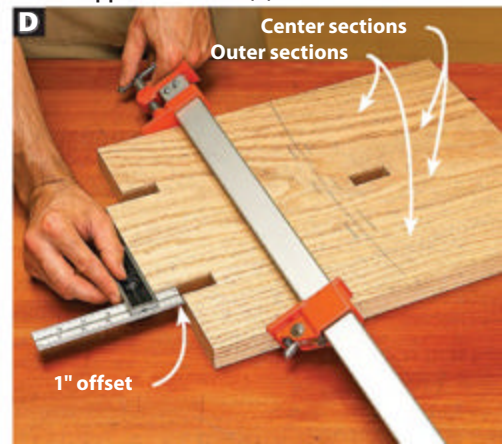


B Again, using the rip fence and miter-gauge extension, cut notches in the top inside edges of the leg (A) outer sections.

Edge-join the leg (A) center-section halves, keeping the ends flush to align the notches, to form a mortise for the lower stretcher (C).



Add the leg (A) outer sections to the center section, offsetting the tops, to form notches for the upper stretchers (B).

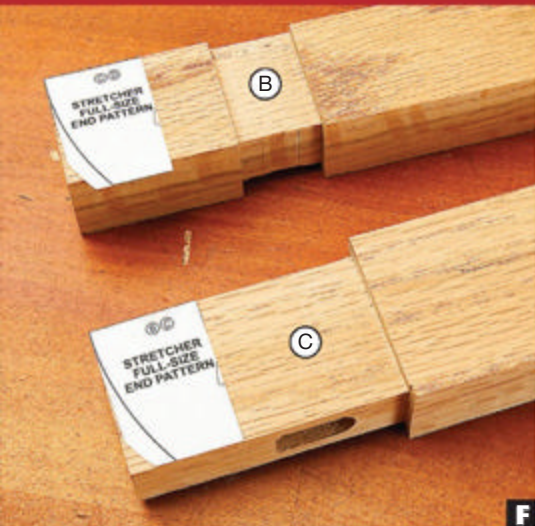


FORM A GROOVE FOR THE WEDGE



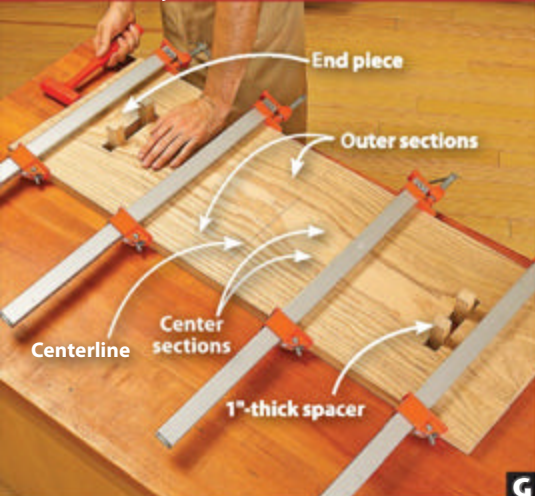
Cut a centered $\frac{1}{8}$ " groove $\frac{3}{4}$ " deep in the tenon at the top of each leg (A) to receive the wedge (E).

APPLY THE END PATTERNS



Adhere the patterns to the stretchers, aligning the top edges. The upper stretcher pattern overhangs the bottom edge.

EDGE-JOIN THE TOP



Inserting spacers between the center-section parts to form mortises for the leg tenons, edge-join the outside sections.

4 Lay out the leg (A) side curves with a fairing stick and the bottom arc with a compass [Drawing 1]. (For a free fairing stick plan, woodmagazine.com/fairing.) Then bandsaw and sand to the lines. Rout $\frac{1}{8}$ " round-overs on the edges and bottom ends. Finish-sand the legs.

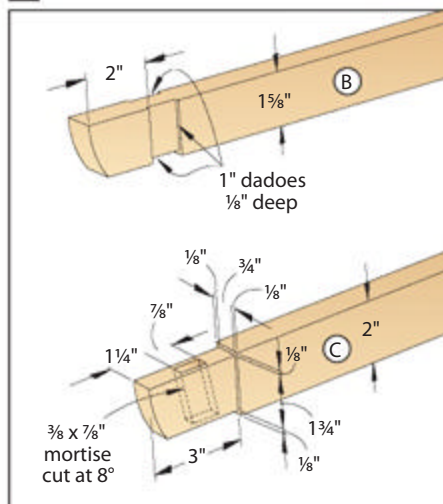
5 To later accept the wedges (E), cut a $\frac{1}{8}$ " groove $\frac{3}{4}$ " deep in the tops of the legs (A) [Photo E].

Make the stretchers

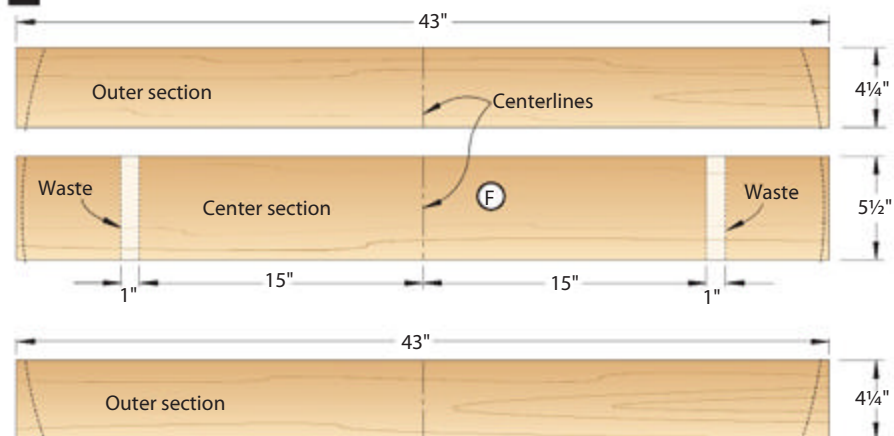
1 Cut the upper stretchers (B) and lower stretcher (C) to size. Then to form angled mortises in the ends of the lower stretcher, chuck a $\frac{3}{8}$ " brad-point bit in your drill press, tilt the table to 8° , and drill overlapping holes [Drawing 3]. Smooth the insides of the mortises with a chisel.

2 Using a $\frac{3}{4}$ " dado blade in your table-saw, form the 1"-wide dadoes in the sides and bottoms of the upper stretchers (B), testing for a snug fit in the four leg (A) notches [Drawings 2 and 3]. Then create a tenon at each end of the lower

3 STRETCHERS DETAIL



4 TOP ASSEMBLY



stretcher (C), testing them for a snug fit in the leg mortises.

3 Photocopy three sets of the **Stretcher End Patterns** on page 19, and adhere them with spray adhesive to the stretchers (B, C) [Photo F]. Then bandsaw and sand the end curves to shape. Finish-sand the stretchers.

Form the keys and wedges

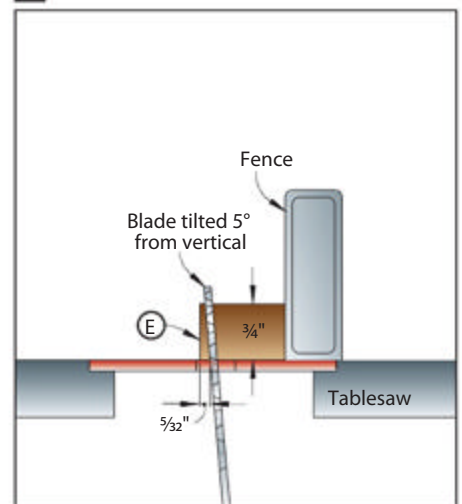
1 Plane stock to $\frac{3}{8}$ " thick for the keys (D). Photocopy the **Key Patterns** on page 19, and adhere them to the $\frac{3}{8}$ " stock. Bandsaw and sand the keys.

2 Cut a $\frac{3}{4}$ " x 12" blank for the wedges (E). Then rip a beveled strip from one edge of the blank [Drawing 5]. Cut two $5\frac{1}{2}$ "-long wedges from the strip.

Top it off

1 For the top (F), cut two boards $1 \times 4\frac{1}{4} \times 43$ " for the outside sections and one $1 \times 5\frac{1}{2} \times 43$ " for the center section [Drawing 4]. The center-section board must be the same width as the length of the tenons at the tops of the legs (A).

5 CUTTING THE WEDGES



Then draw centerlines across the widths of the boards. To form the mortises, cut away the waste portions, where shown. Mark the orientation of the end pieces of the center section for reassembly.

2 Before gluing up the top (F), cut four 1"-thick spacers from scrap. Make certain they are the same thickness as the tenons on the ends (A). Then glue and clamp the top (F) [Photo G]. Remove the spacers and let the glue dry.

3 Lay out the top (F) end arcs with a beam compass [Drawing 2], and bandsaw or jigsaw and sand to the lines. Then rout ¼" round-overs on all ends and edges of the top. To make it easy to insert the snug-fitting leg (A) tenons into the top mortises, see **Shop Tip 13** below. Finish-sand the top.

Now put it together

1 Dry-fit the legs (A), stretchers (B, C), and top (F) without keys (D) or wedges (E), and make any necessary adjustments. When satisfied with the

fit, insert the lower stretcher (C) into the legs and tap the keys into place [Photo H]. (Glue isn't needed with this joint.)

2 Apply glue to the dados in the upper stretchers (B), and slide them into the notches in the ends (A) [Photo I].

3 Apply glue to the top edges of the upper stretchers (B). Then, capturing the leg (A) tenons in the top (F) mortises, tap the top into place with a mallet. Apply glue to the wedges (E), and tap them into the tenon grooves [Photo J].

4 With the glue dry, sand the wedges flush with the top (F). Inspect all the parts and finish-sand, where needed.

5 Apply the finish. (We used Varathane Premium Wood Stain no. 206 Summer Oak, topped with three coats of Aqua Zar water-based satin polyurethane, sanding with 220-grit sandpaper between coats.)

Written by **Mark Lane** and **Jan Svec**

Project design: **Kevin Boyle**

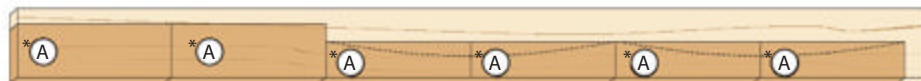
Illustrations: **Roxanne LeMoine; Lorna Johnson**

SHOPTIP 13

Easing mortise edges eases assembly

Dry-fitting and final assembly go faster when mortises and tenons come together without a fight. Easing the edges of a mortise guides the tenon into place. To do this when fitting the bench-leg (A) tenons into the top (F) mortises, chuck a 45° chamfer bit in your handheld router and adjust it to cut ⅛" deep. Make a pass around the mortises on the underside of the top (F), and clean up the corners with a chisel.

Cutting Diagram



1 x 7¼ x 96" Red oak (6.7 bd. ft.) *Plane or resaw to the thicknesses listed in the Materials List.



1 x 7¼ x 96" Red oak (6.7 bd. ft.)



1 x 5½ x 96" Red oak (5 bd. ft.)



¾ x 3½ x 12" Walnut (.3 bd. ft.)

Materials List

Part	FINISHED SIZE			Matl.	Qty.
	T	W	L		
A* legs	1"	13"	16"	EO	2
B upper stretchers	1"	1½"	36"	O	2
C lower stretcher	1"	2"	36"	O	1
D* keys	¾"	1½"	3½"	W	2
E* wedges	¾"	5½"	5½"	W	2
F* top	1"	14"	42"	EO	1

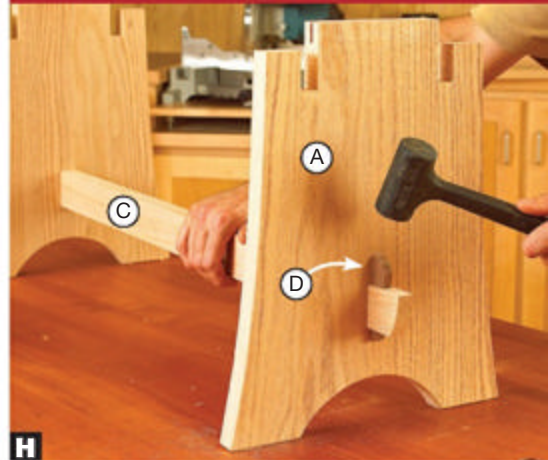
*Parts initially cut oversize. See the instructions.

Materials key: EO—edge-jointed oak, O—oak, W—walnut.

Supply: Spray adhesive.

Blade and bits: Stacked dado set, ⅛" and ¼" round-over router bits, ⅜" brad-point bit.

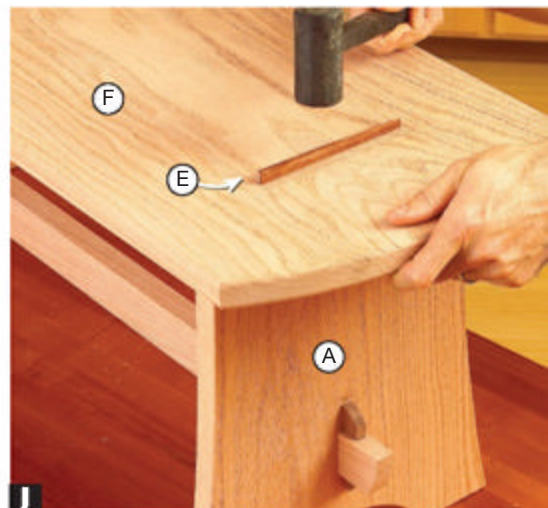
ASSEMBLY IS EASY AS 1-2-3



H Begin assembly by inserting the lower-stretcher (C) tenons into the leg (A) mortises, and tapping the keys (D) firmly into place.



I Spread glue in the upper-stretcher (B) dados, and tap the stretchers into the notches in the legs (A).



J With the top (F) in place, apply glue to the wedges (E) and tap them into the grooved tenons of the legs (A).

Find more country furniture plans at:
woodmagazine.com/country





BONUS: See a Slide Show
of extra project assembly shots at:
woodmagazine.com/shelfslides

super-simple

Shelves for Show

PROJECT HIGHLIGHTS

- It assembles quickly and easily with biscuits, screws, and dado joints.
- Overall dimensions are 44" wide x 17½" deep x 79" high.
- Materials needed: Red oak (we used quartersawn) and red-oak plywood.

Skill Builders

- Plunge in and learn the ABCs of biscuit joinery.
- Discover how to assemble a large project in stages with a few clamps.

Start with the legs

1 Cut the front/back and side legs (A, B) to the sizes listed [Materials List, page 28]. Lay out the angled end at the bottom of a leg [Drawing 1]. Bandsaw and sand to the line. Using this leg as a template, mark the angle on the remaining front/back and side legs. Bandsaw and sand them to shape.

2 Pair together the front/back and side legs (A, B). Noting the orientation of the angled ends for each pair [Drawing 2], identify the location (left front, right rear, etc.) and the *inside* face on each leg to ensure correct machining and assembly. Then, using a dado blade in your tablesaw, cut a ¾" dado ¼" deep on the *inside* face of each side leg, where dimensioned, to fit the front/back legs [Drawings 1 and 1a].

3 Mark centerpoints on masking tape for ¼" holes ⅜" deep on the *inside* face of the side legs (B) [Drawing 1, Photo A] to receive ¼" shelf supports. Using a Brad-point bit wrapped with a piece of masking tape for a visual depth stop, drill the holes. Sand the legs to 220 grit.

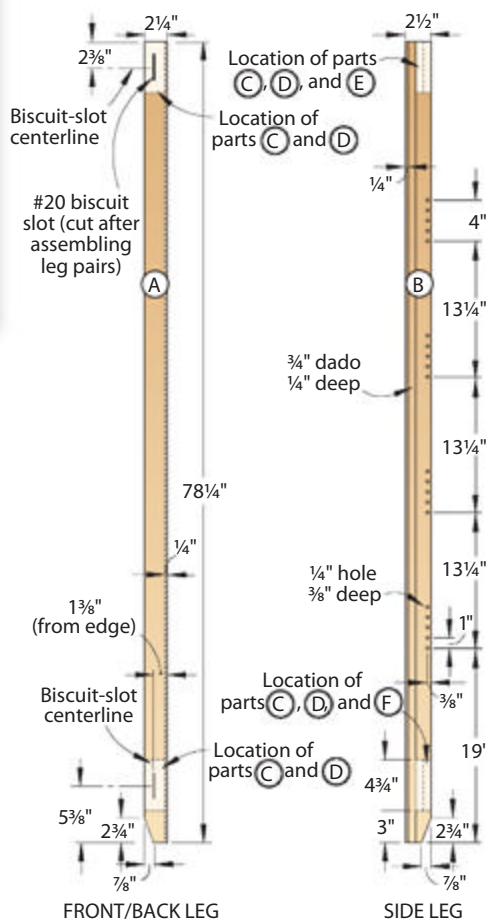
4 For each pair of legs (A/B), glue and clamp the front/back leg (A) in the dado in the side leg (B), keeping the ends flush.

Make the rail assemblies

1 Cut the top/bottom front rails (C), top/bottom back rails (D), top side rails (E), bottom side rails (F), and top cleats (G) to the sizes listed.

2 Mark centerlines for #20 biscuit slots on the front/back legs (A) and parts C through G [Drawings 1 and 3]. Using your biscuit joiner with the parts clamped to your workbench for safety, plunge a centered slot at each marked location, except the mating locations on the front/back legs and *outside* face of the top/bottom front and back rails (C, D). You'll plunge these after assembling the top and bottom rail assemblies.

1 LEGS (Inside face of left-front and right-rear leg pairs shown)



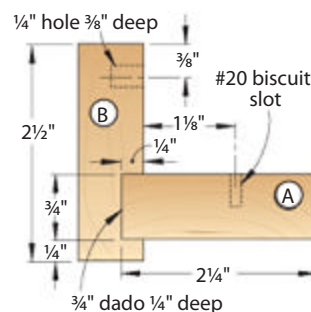
Note: Left-rear and right-front leg pairs are mirror image.

3 To mount the top (O) later, mark centerpoints ⅜" apart for drilling end holes to form a centered ⅜" slot ⅜" long at each end of the top cleats (G) [Drawing 3a]. Drill ⅜" holes at the marked points. Then drill overlapping holes to complete the slots. Now drill a centered countersunk shank hole in the *bottom* face of each cleat.

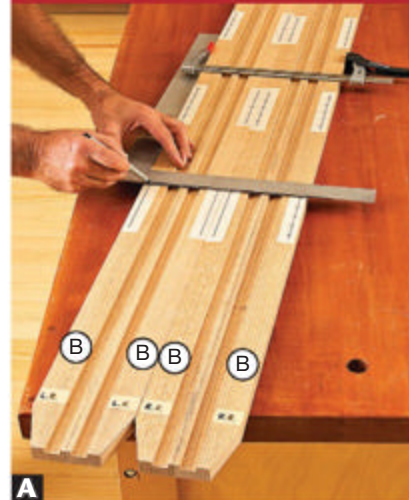
4 Mark the centers and ends of the arches on the top/bottom front rails (C) and bottom side rails (F) [Drawing 3]. Draw the arches using a fairing stick. (Go to woodmagazine.com/fairing for a free fairing stick plan.) Bandsaw and drum-sand the four arches.

5 Sand parts C through G smooth. Then glue each top side rail (E) to a top cleat (G), keeping the parts square. Next, glue, biscuit, and clamp the side rail/cleat assemblies and remaining center top cleat to the top back rail (D) [Drawing 3]. (Positioning the parts upside down makes this easy.) Now add the top front rail (C) [Photo B].

1a TOP VIEW (Left-front and right-rear leg pairs shown)



MARK SHELF-SUPPORT HOLES



A Clamp the side legs (B) together with the ends flush. Mark centerpoints for shelf-support holes on the legs using a square.

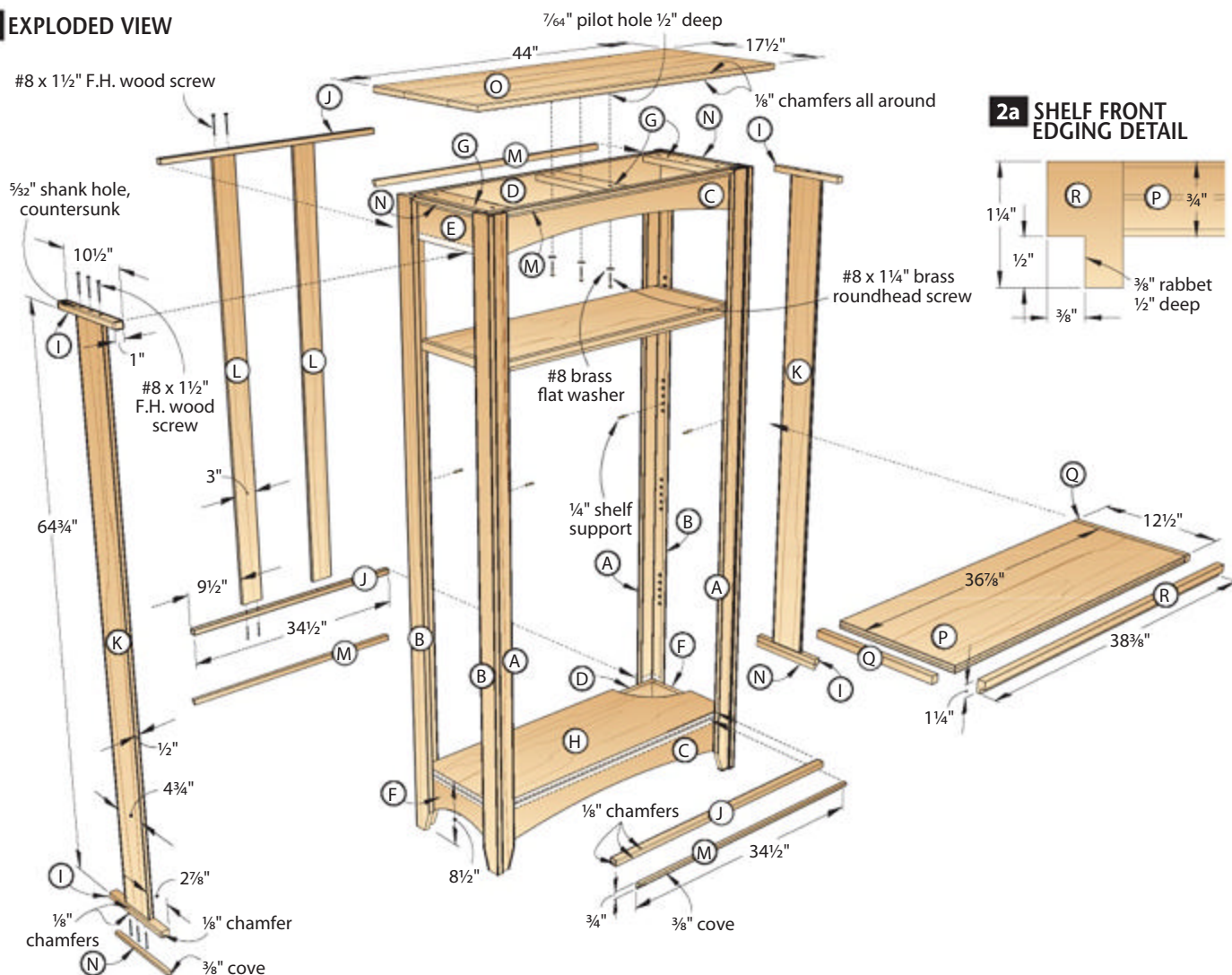
COMPLETE THE TOP-RAIL ASSEMBLY



B With the side rails (E) and cleats (G) glued to the back rail (D), glue, biscuit, and clamp the front rail (C) to the assembly.

6 To assemble the bottom rails and shelf: Glue, biscuit, and clamp together the bottom front rail (C), back rail (D), and side rails (F). Measure for equal diagonals to verify square. Cut the bottom shelf (H) to size to fit the assembly. Sand smooth. Glue the shelf to the assembly, with edges and ends flush.

2 EXPLODED VIEW



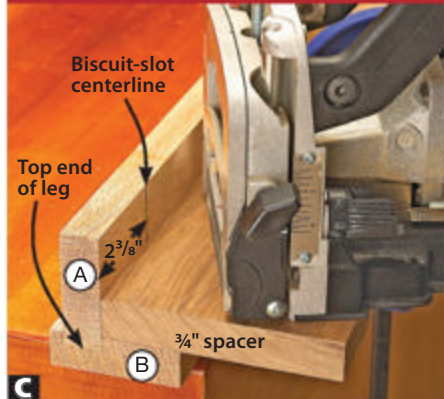
7 To cut the biscuit slots in the front/back legs (A), place a 3/4"-thick spacer under your biscuit joiner and plunge the slots at the marked locations [Photo C]. (This correctly positions the center of the biscuit slots 1 1/8" from

the bottom of the spacer.) Again using the spacer, cut the mating slots in the face of the top/bottom front and back rails (C, D).

8 Glue, biscuit, and clamp the back legs (A/B) to the top rail/cleat

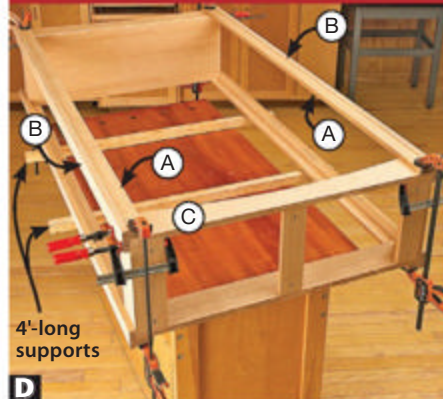
assembly (C/D/E/G) and bottom rail/shelf assembly (C/D/F/H) [Drawings 2 and 3], making sure that the legs and top rail/cleat assembly are flush at the top. Add the front legs to the assemblies [Photo D].

PLUNGE THE LEG BISCUIT SLOTS



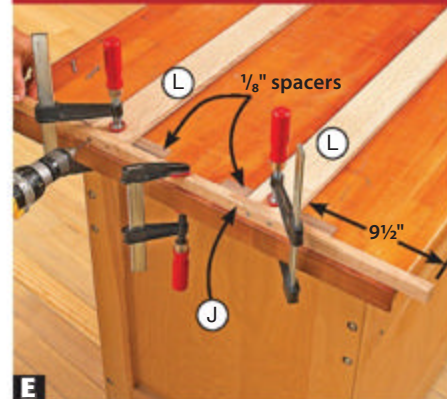
Place a 3/4"-thick spacer under your biscuit joiner on the *inside* face of a side leg (B). Plunge the slot into the front or back leg (A).

ATTACH THE FRONT LEGS



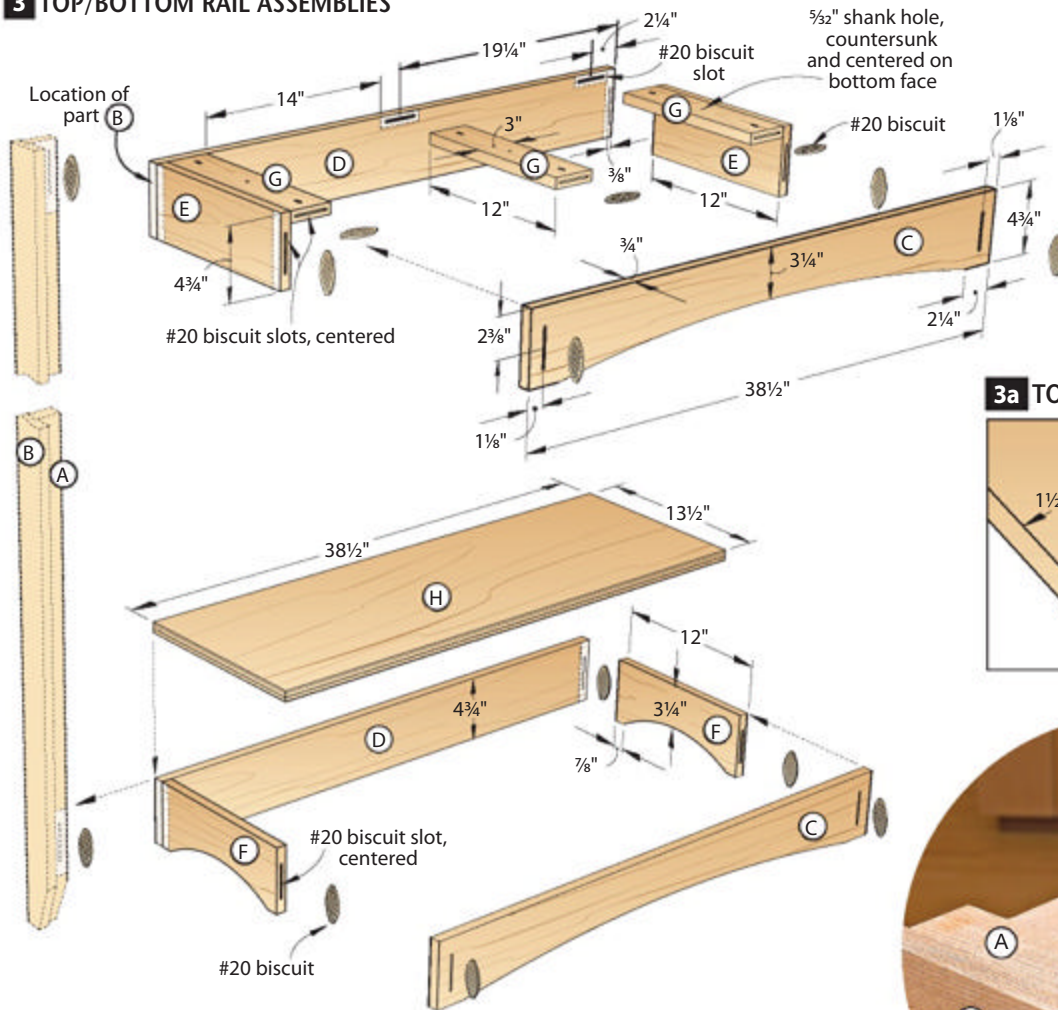
After attaching the back legs (A/B) to the rail assemblies, turn the unit over. Glue, biscuit, and clamp the front legs in place.

ASSEMBLE THE BACK SLATS AND TRIM

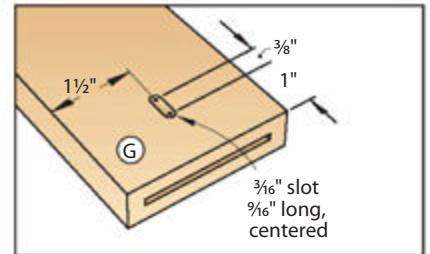


With the back slats (L) on 1/8" spacers and positioned 9 1/2" from the ends of the back trim (J), screw-mount the trim to the slats.

3 TOP/BOTTOM RAIL ASSEMBLIES



3a TOP CLEAT SLOT DETAIL



Add the trim and slats

1 Cut the side trim (I) and front/back trim (J) to the sizes listed. (To ensure a snug fit, we measured between the legs for the exact lengths of the trim. Then we identified the locations of the pieces to ensure correct assembly.) Cut the side slats (K) and back slats (L) to the indicated sizes.

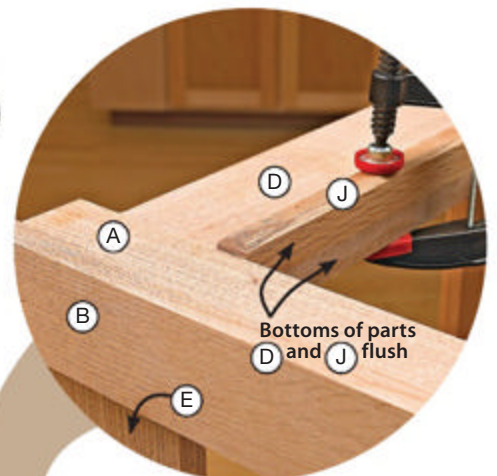
2 Rout $\frac{1}{8}$ " chamfers along the edges and ends of the side trim (I) and front/back trim (J) [Drawings 2 and 4]. Sand the trim and slats (K, L).

3 To assemble the top and bottom back trim (J) and back slats (L), lay out the parts with the faces up on a flat worksurface. Place spacers under the slats to position them $\frac{1}{8}$ " from the *inside* face of the trim [Drawing 4, Photo E]. Locate the slats $\frac{9}{16}$ " from the ends of the trim [Drawing 2]. Clamp the trim and slats to your worksurface. Drill mounting holes through the trim and centered into the slats. Drive the screws. Again using the spacers, mount the side trim (I), centered end to end, to the side slats (K).

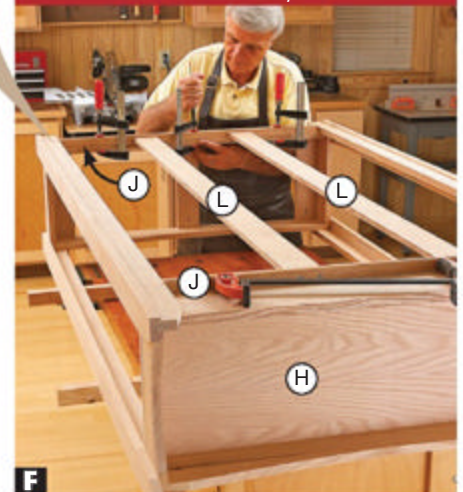
4 To mount the back trim/slat assembly (J/L), apply glue to the *inside* (nonchamfered) edges of the trim. Clamp the assembly in position on the shelving unit, keeping the *bottom* face of the top trim and bottom edge of the top back rail (D) flush [Drawing 4, Photo F]. Note that the *top* face of the bottom trim (J) is $\frac{1}{4}$ " proud of the bottom shelf (H). Mount the side trim/slat assemblies (I/K) to the unit, positioning them on the unit in the same way as described *above*.

5 Glue and clamp the bottom front trim (J) to the bottom shelf (H), flush with the top face. Sand the joint smooth.

6 To form the front/back and side cove trim (M, N), cut a $\frac{1}{2}$ " \times 6" \times 36" blank. Rout a $\frac{3}{8}$ " cove along each edge of the blank. Then rip a $\frac{3}{4}$ "-wide strip from each edge. Repeat to make four more strips. Then crosscut the front/back and side trim pieces to length from the strips to fit snugly between the legs. Glue and clamp the trim pieces in place [Drawing 2].



MOUNT THE BACK TRIM/SLATS



F Glue and clamp the back trim/slat assembly (J/L) in place, aligning the *bottoms* of the top back trim (J) and back rail (D) flush.

On to the top and shelves

1 Edge-join stock to form an 18×44½" piece for the top (O). Then crosscut and rip the top to the finished size of 17½×44". Rout ⅛" chamfers along the top and bottom edges and ends of the top [Drawings 2 and 4]. Sand the top smooth.

2 Clamp the top (O) to the unit, centered front-to-back and side-to-side. Using the mounting holes and slots in the top cleats (G) as guides, drill pilot holes in the top. Drive the brass roundhead screws with flat washers [Drawing 2].

3 Cut the shelves (P) to size. Cut the shelf end and front edging (Q, R) to the sizes listed. Cut a ⅜" rabbet ½" deep in the front edging [Drawing 2a], using a dado blade. Glue and clamp the edging to the shelves, flush with the top faces. Sand the assemblies smooth.

Finish up

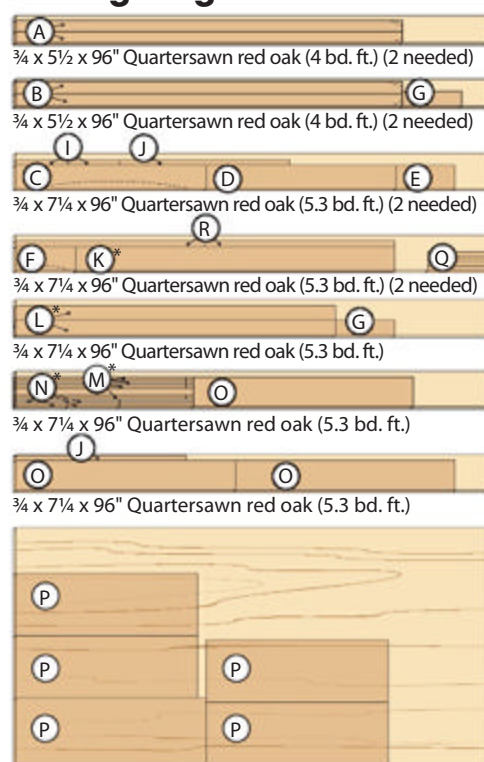
1 For ease of finishing, remove the top (O). Finish-sand any areas of the unit that need it to 220 grit. Remove the dust.

2 Finish the project as you wish. For two easy-to-apply and great-looking finish options, see *opposite*. (We chose the General Finishes water-based Early American stain and a water-based polyurethane topcoat for our project.)

3 Remount the top (O). Then install the shelves, where you wish, using ¼" shelf supports. Now place some favorite decorative pieces and other items on the shelves, and step back to admire them and your amazing handiwork. 🍷

Written by **Owen Duvall** with **Chuck Hedlund**
Project design: **Jeff Mertz**
Illustrations: **Roxanne LeMoine; Lorna Johnson**

Cutting Diagram



¾ x 48 x 96" Red oak plywood

*Plane or resaw to the thickness listed in the Materials List.

Materials List

Part	FINISHED SIZE			Matl.	Qty.
	T	W	L		
A front/back legs	¾"	2¼"	78¾"	QO	4
B side legs	¾"	2½"	78¾"	QO	4
C top/bottom front rails	¾"	4¾"	38½"	QO	2
D top/bottom back rails	¾"	4¾"	38½"	QO	2
E top side rails	¾"	4¾"	12"	QO	2
F bottom side rails	¾"	4¾"	12"	QO	2
G top cleats	¾"	3"	12"	QO	3
H bottom shelf	¾"	13½"	38½"	OP	1
I side trim	¾"	1"	10½"	QO	4
J front/back trim	¾"	1"	34½"	QO	3
K side slats	½"	4¾"	64¾"	QO	2
L back slats	½"	3"	64¾"	QO	2
M* front/back cove trim	½"	¾"	34½"	QO	4
N* side cove trim	½"	¾"	10½"	QO	4
O* top	¾"	17½"	44"	EQO	1
P shelves	¾"	12½"	36⅞"	OP	4
Q shelf end edging	¾"	¾"	12½"	QO	8
R shelf front edging	¾"	1¼"	38⅞"	QO	4

*Parts initially cut oversize. See the instructions.

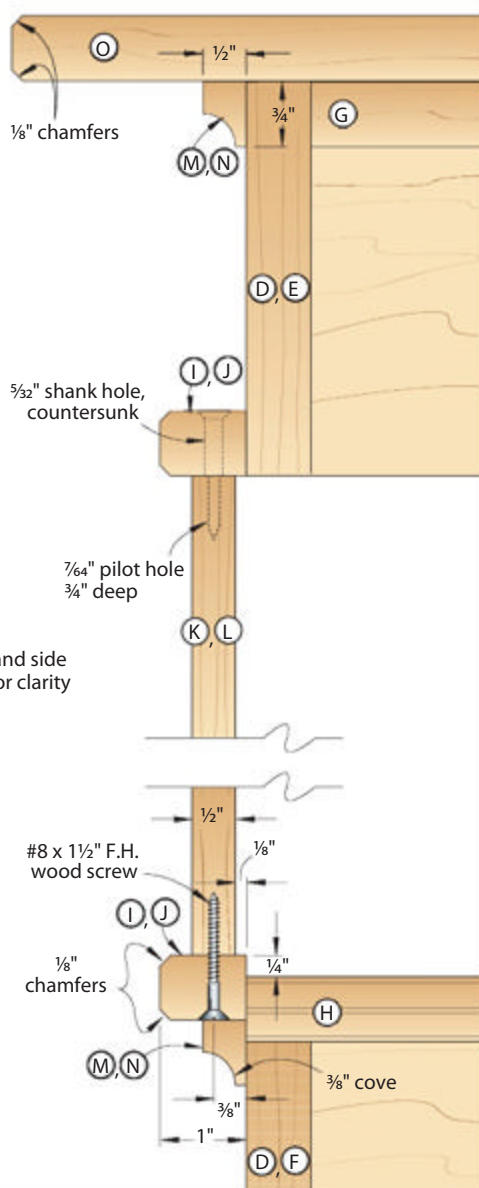
Materials key: QO—quartersawn red oak, OP—red-oak plywood, EQO—edge-joined quartersawn red oak.

Supplies: #20 biscuits, #8×1½" flathead wood screws (20), #8×1¼" brass roundhead screws (9), #8 brass flat washers (9), ¼" shelf supports (16).

Blade and bits: Dado-blade set, ¼" brad-point bit, ⅜" cove and 45° chamfer router bits.

4 SIDE/BACK SECTION VIEW

Note: Front/back legs (B) and side legs (A) not shown for clarity

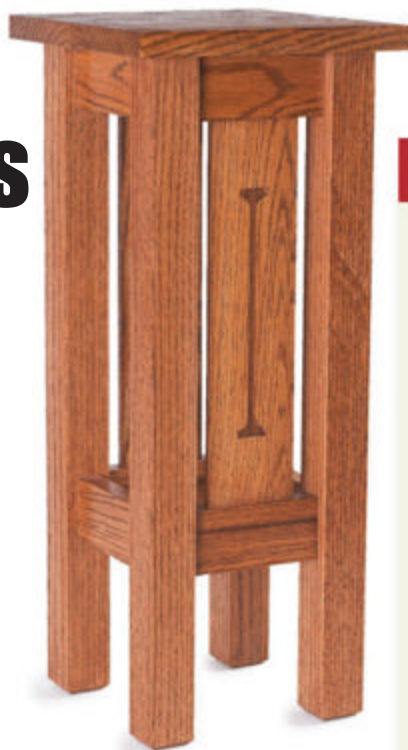


Easy Oak Finishing Tips

A low-odor choice for indoor finishing

Water-based stains and finishes have become popular in commercial and home shops across North America. For the display shelves on *page 24* and the table shown at *right*, we applied General Finishes EarlyAmerican water-based stain and ZAR Ultra Max water-based satin polyurethane.

Speaking from experience, water-based stain can be a challenge to apply. Leave it on a few seconds too long, even under ideal conditions, and it quickly dries. Dry air only exacerbates the problem. For best results, try these tips.



SHOPTIPS 14–15

● **Remove excess stain.** To remove dried excess stain, make a couple of passes with a moistened coarse cloth, such as burlap, as shown in **Photo A**, until the color evens out.

● **Wipe on, wipe off.** Stain application method: Wipe stain on with a soft cloth towel; then remove it immediately with a clean towel, as shown in **Photo B**.



A A moistened, coarse cloth (burlap is a good choice) can remove dried deposits of water-based stain. Then re-stain for an even color.



B Apply stain with a circular motion to work pigments into the pores. Then wipe with the grain and remove any surplus.

SHOPTIPS 16–23

● **Avoid blotchy stain.** Sanding up to 220 grit reduces blotching. Just know that the smooth surface traps fewer stain pigment particles and produces a lighter color.

● **Avoid lap marks.** Work quickly in small areas, but keep overlaps to a minimum to avoid lap marks. Stain long project pieces, like the legs on the display shelf, using generous amounts of stain in long strokes.

● **Reapply to darken.** To slightly darken light spots, remoisten the towel used to apply the stain, and gently wipe the light section until the color matches the surrounding surfaces.

● **Matching plywood and solid oak.** Take care when staining projects that mix veneer plywood and solid oak. The plywood may require additional stain applications because it absorbs less stain, producing a lighter color.

● **Dealing with raised grain.** Should the stain raise the wood grain slightly, make three light passes over the stained areas using 320-grit abrasive. Be careful not to sand through the stain; if you do, you'll need to reapply stain.

● **Avoid clogged spray equipment.** Water-based finish dries quickly, even inside a spray gun. Clean spray equipment between coats to prevent finish from clogging the sprayer.

● **Brush or spray on finish.** To apply the topcoat, brush on or spray on with a touch-up sprayer. The touch-up sprayer produces less overspray than a full-size spray gun.

● **Three coats complete the job.** One coat of finish seals the wood; apply two additional topcoats to protect the wood from spills and fingerprints. 🌲

Sources

Stains: Early American water-based stain, call General Finishes at 800-783-6050, or visit generalfinishes.com.

ZAR Ultra Max water-based satin poly: United Gilsonite Laboratories, call 800-845-5227 or visit ugl.com.

Table plans: The table shown *above* is based on the smallest of a set of mission nesting tables, plan no. DP-00015. Purchase the plans at woodmagazine.com/nesttables.

child-pleasing

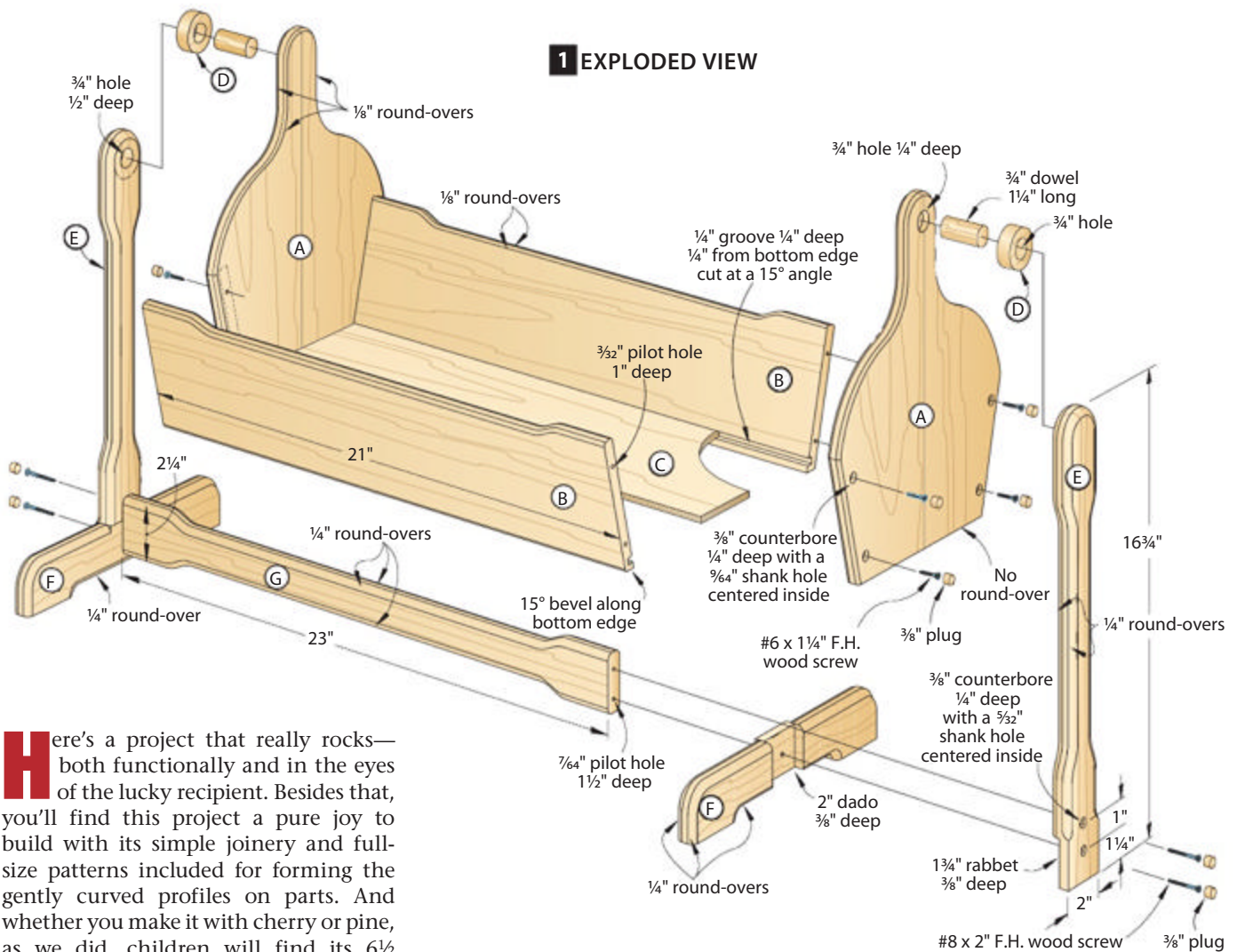
Pendulum Cradle

We scaled this playroom piece to comfortably fit popular dolls around 18" tall.



Fashioning the cradle from cherry, as featured above, gives it a warm and traditional look. Making it from pine, and painting it a color of your choice, lends a more casual appearance, as shown at left.

1 EXPLODED VIEW



Here's a project that really rocks—both functionally and in the eyes of the lucky recipient. Besides that, you'll find this project a pure joy to build with its simple joinery and full-size patterns included for forming the gently curved profiles on parts. And whether you make it with cherry or pine, as we did, children will find its 6½ pounds easy to tote from place to place.

First up: the cradle parts

1 Edge-join enough 3/4"-thick stock to form an 11×27" blank for the ends (A). Plane the blank to 1/2" thick, and crosscut it to form two 11×13" blanks.

2 From 1/4" hardboard, cut an 11×13" blank to form a template for the end pieces. Make two photocopies of the **End Pattern** on page 34. Trim the patterns to shape. Turn one pattern over, and align and tape it to the other pattern to make a complete end pattern. Using a nail or an awl, punch a small hole through the pattern at the centerpoints for the four 3/8" counterbores and for the 3/4" hole at the top. Adhere the pattern to the template with spray adhesive. Bandsaw and sand the template to shape. Then drill 1/8" holes through the template at the punched-hole locations.

3 Place the template on the outside face of one of the 11×13" blanks with the bottom edges aligned, and transfer

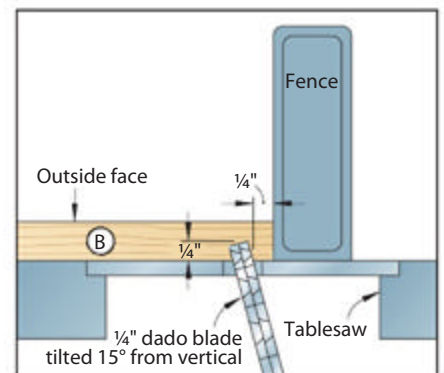
the shape to the blank. Insert a nail or an awl into each of the 1/8" holes in the template and mark the hole centerpoints on the blank. Now mark the other blank.

4 Bandsaw and sand the blanks to shape. Using a 3/4" Forstner bit and centering it on the marked-hole location at the top of each blank, drill a 1/4"-deep hole to receive the cradle dowel. Now rout 1/8" round-overs on all edges except the bottom, where shown on **Drawing 1**, and sand the routed edges smooth. You'll drill the 3/8" counterbores later.

5 Cut the sides (B) to the size listed in the **Materials List**. Referring to **Drawings 1** and **1a**, bevel-rip a 1/4" groove 1/4" deep and 1/4" from the bottom of each side piece on its inside face to receive the bottom (C). Then bevel-rip a 15° angle along the bottom edge of both pieces, where shown.

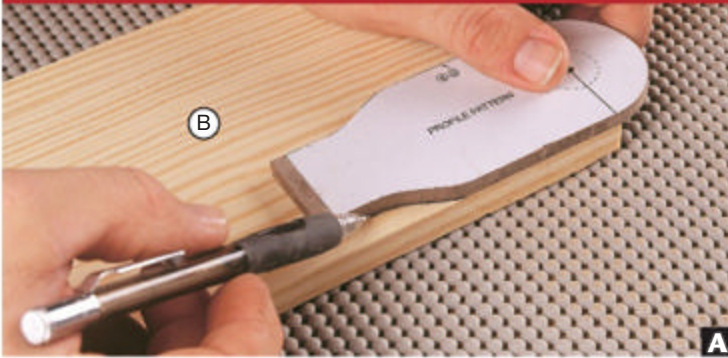
6 From 1/4" hardboard, cut a 2½×5" blank to form a profile template. You'll use it to mark the profile on the sides (B), and later the supports (E) and

1a GROOVE-CUTTING DETAIL



the stretcher (G). Make a photocopy of the **Profile Pattern** on page 34. Adhere the pattern to the hardboard with spray adhesive. Bandsaw and sand the template to shape. Then drill a 1/8" marking hole through the template where shown on the pattern.

LAY OUT SIDE PROFILE



Use the template to mark the profile on one face of the sides (B) along the top edge at each end. Use a straightedge to draw a line connecting the profiles.

7 Refer to **Drawing 1** for the location of the profile on the sides (B). Then, using the profile template, mark the profile on the side pieces, as shown in **Photo A**. Bandsaw and sand to the marked lines on each piece. Next rout $\frac{1}{8}$ " round-overs along the top edges, where shown in **Drawing 1**.

8 From $\frac{1}{4}$ " hardwood plywood, cut the bottom (C) to size. Now finish-sand the ends, sides, and bottom to 220 grit.

Assemble the cradle

1 From a $\frac{3}{4}$ "-diameter dowel, cut two pieces $1\frac{1}{4}$ " long. Glue a dowel in the top hole in each end piece (A).

2 Dry-assemble (no glue) the end pieces, the sides (B), and the bottom (C), as shown in **Photo B**. Using a $\frac{3}{8}$ " Forstner bit, drill counterbores $\frac{1}{4}$ " deep at the marked locations on the ends (A). Drill pilot and countersunk shank holes centered in the counterbores, where shown on **Drawing 1**. Then drive in the flathead screws.

3 Using a $\frac{3}{8}$ " plug cutter, cut 12 plugs $\frac{3}{8}$ " long from leftover material.

SHOPTIP 24 Make plugs blend in. Match wood color and grain if you plan to stain your project. For best appearance, align the plugs' grain with that of the surrounding wood.

Set aside four plugs. Glue the remaining plugs in the counterbores. With the glue dry (it's best to let it dry overnight), sand the plugs flush.

Make the support frame

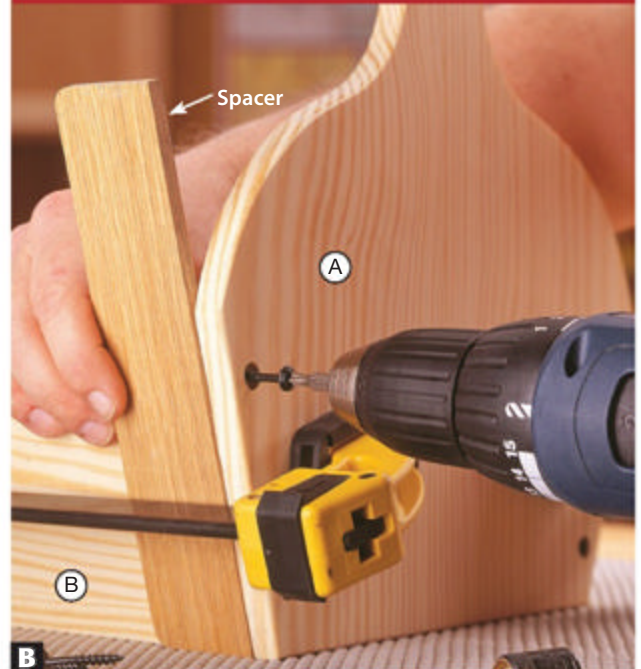
1 From $\frac{1}{2}$ "-thick stock, use a circle cutter to cut two $1\frac{1}{2}$ "-diameter discs for the spacers (D). Clamp a disc, with a backer board underneath, in a handscrew or drill-press vise. After centering on the circle cutter's pilot hole, drill a $\frac{3}{4}$ " hole through the spacer. Repeat for the other spacer. Then sand the spacers and set them aside.

2 Cut the supports (E), feet (F), and stretcher (G) to size. Cut a 2" dado $\frac{3}{8}$ " deep on the outside face of the feet and a mating $1\frac{3}{4}$ " rabbet $\frac{3}{8}$ " deep on the inside face of the supports, where shown on **Drawing 1**, to form a lap joint.

3 Referring to **Drawing 2**, lay out the 1" radii at the top ends of the feet (F) and the $\frac{1}{4}$ " cutout at the bottom. Bandsaw the feet to shape, and sand smooth.

4 Refer to **Drawing 1** for the location of the profile on the supports (E). Then mark the profile at the bottom of a support on its inside face, as shown in **Photo C**. Reposition the template at the top of the support with the rounded top end of the template flush with the

SPACE SIDES IN FROM EDGES OF ENDS



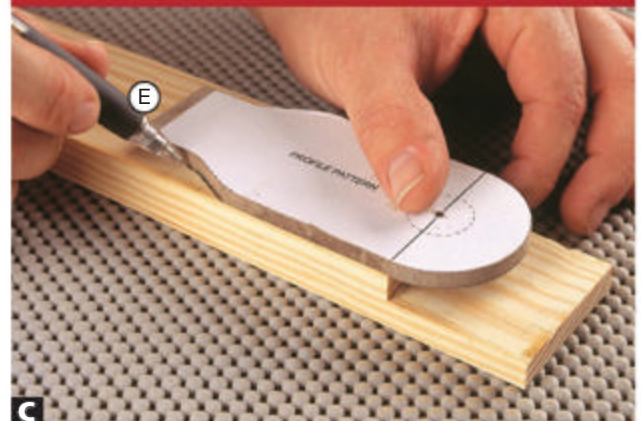
Position the sides (B) $\frac{1}{4}$ " back from the edges of the ends (A) by placing $\frac{1}{4}$ "-thick spacers between the clamp's bar and the sides at both ends.

support's end. Mark the complete template contour on the support. Also insert a nail or an awl through the $\frac{1}{8}$ " hole in the template, and mark the centerpoint for the $\frac{3}{4}$ " hole for the cradle dowel. Draw lines to connect the contours along both edges of the support. Mark the other support.

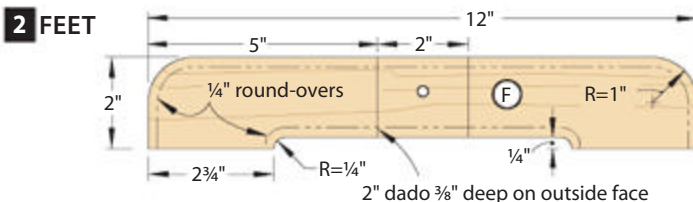
5 Bandsaw and sand the two supports (E) to shape. Using a $\frac{3}{4}$ " Forstner bit, drill a $\frac{1}{2}$ "-deep hole at the marked location on each part.

6 Using the template, mark the profile on both ends of the stretcher (G) along both edges, where shown on

MARK PROFILE ON SUPPORT



With the profile template positioned on the inside face of a support (E) and aligned with the rabbet's top edge, mark the profile on the support.



INSTALL STRETCHER



D With the stretcher (G) supported on the spacers and clamped between the support assemblies, drill pilot holes into the stretchers, and drive in the screws.

Drawing 1. Draw lines to join the profiles; then bandsaw and sand the stretcher to shape. Rout $\frac{1}{4}$ " round-overs along the top and bottom edges of the stretcher, where shown.

7 Glue and clamp the supports (E) to the feet (F). With the glue dry, rout $\frac{1}{4}$ " round-overs along the top edges of the assemblies and on the cutout area at the bottom of the feet, where shown. Then using a $\frac{3}{8}$ " Forstner bit, drill $\frac{1}{4}$ "-deep counterbores on the outside face of the supports, where shown. Do not drill the countersunk shank holes in the counterbores until indicated.

8 To temporarily align the spacers (D) with the supports (E) during glue-up, cut two $1\frac{1}{2}$ "-long pieces from a $\frac{3}{4}$ " dowel. Insert a dowel (no glue) into the hole in the top of each support. (The extra $\frac{1}{4}$ " allows you to pull the dowels out of the hole after the glue dries.) Now

glue and clamp the spacers (D) to the supports, centering them on the dowels. Remove the dowels.

Assemble and apply the finish

1 Mark a centerline on the top edge of the stretcher (G) at both ends, and mark a centerline with the grain on the inside face of the supports (E).

2 From scrap, cut two $\frac{7}{8}$ "-thick spacers 6" long for positioning the stretcher against the supports.

3 With the stretcher supported by the spacers at each end, clamp the support assemblies (E/F) to the stretcher, as shown in **Photo D**, aligning the stretcher and support centerlines. Now, in the center of the counterbores in the supports, drill pilot and countersunk shank holes for the mounting screws to the depth shown on **Drawing 1**, and drive in the screws. Sand the assembled frame to 220 grit, and remove the dust.

4 Remove the screws from one support assembly, and separate it from the frame. Then check the fit of the dowels in the cradle ends (A) with the hole in the spacer (D) on the removed support. Sand the dowels as necessary so they rotate freely in the spacer but are not loose. With the free end of the stretcher supported by a $\frac{7}{8}$ "-thick spacer, install the cradle in the frame, as shown in **Shop Tip 25** above right. Then drive the screws to reattach the removed support assembly. Finally, glue the four plugs that you set aside earlier in the counterbores in the supports. Let the glue dry overnight, then sand the plugs flush.

5 Check for any roughness and sharp edges, then sand as needed. Remove the dust. To finish the cherry doll cradle, apply a stain followed by two coats of a clear finish, sanding to 320 grit between coats. (We used Minwax Cherrywood Gel Stain and aerosol polyurethane.)

Cutting Diagram



$\frac{3}{4}$ x $7\frac{1}{4}$ x 60" Cherry (3.3 bd. ft.)

*Plane or resaw to the thickness listed in the Materials List.



$\frac{3}{4}$ x $7\frac{1}{4}$ x 60" Cherry (2.7 bd. ft.)



$\frac{1}{4}$ x 24 x 24" Hardwood plywood



$\frac{3}{4}$ x $3\frac{1}{2}$ x 96" Cherry (2.7 bd. ft.)

SHOP TIP 25



Paraffin lubricates

For smooth action, apply paraffin wax to the dowels; then install the cradle between the supports. To simplify the task, clamp the cradle to the support at one end to ease assembly at the opposite end.

6 To finish the pine doll cradle, apply two coats of primer, sanding between coats to 220 grit. Then apply two coats of a paint of your choice. (We used Glidden's interior latex flat paint, tinted Seed Pearl.)

Written by **Owen Duvall**

Project design: **Jeff Mertz**

Illustrations: **Roxanne LeMoine; Lorna Johnson**

Materials List

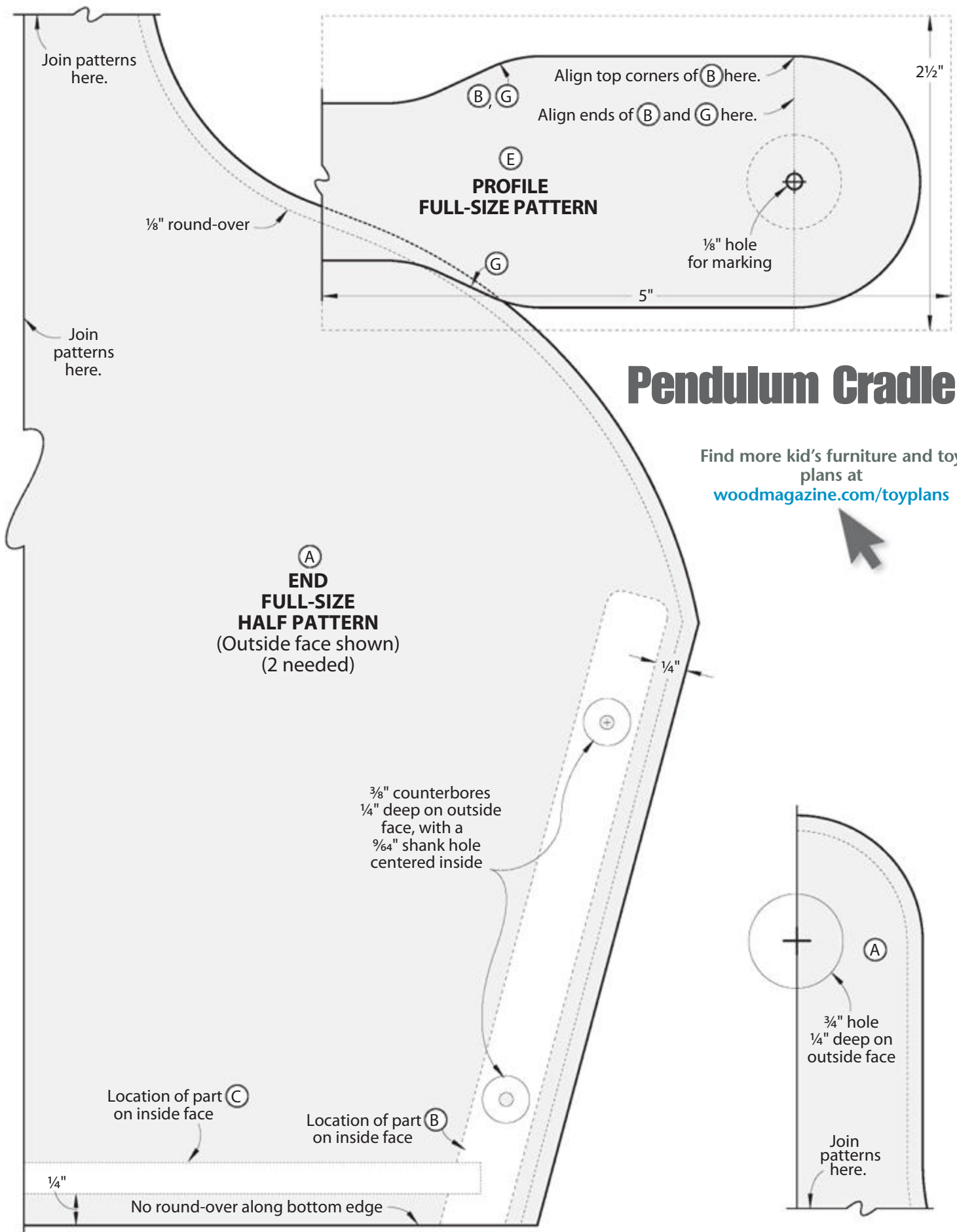
Part	FINISHED SIZE			Matl.	Qty.
	T	W	L		
A* ends	$\frac{1}{2}$ "	10 $\frac{3}{4}$ "	12 $\frac{3}{4}$ "	EC	2
B sides	$\frac{1}{2}$ "	5 $\frac{1}{4}$ "	21"	C	2
C bottom	$\frac{1}{4}$ "	7 $\frac{1}{4}$ "	21"	HP	1
D spacers	$\frac{1}{2}$ "	1 $\frac{1}{2}$ " diam.		C	2
E supports	$\frac{3}{4}$ "	2"	16 $\frac{3}{4}$ "	C	2
F feet	$\frac{3}{4}$ "	2"	12"	C	2
G stretcher	$\frac{3}{4}$ "	2 $\frac{1}{4}$ "	23"	C	1

*Parts initially cut oversize. See the instructions.

Materials key: EC—edge-joined cherry or pine, C—choice of cherry or pine, HP—hardwood plywood.

Supplies: $\frac{1}{4}$ " hardboard, #6x1 $\frac{1}{4}$ " and #8x2" flathead wood screws, spray adhesive, $\frac{3}{4}$ "-diameter dowel 6" long, paraffin wax.

Blade and bits: Stacked dado blade, $\frac{3}{8}$ " and $\frac{1}{4}$ " Forstner bits, $\frac{1}{8}$ " and $\frac{1}{4}$ " round-over bits, $\frac{3}{8}$ " plug cutter, adjustable circle cutter.



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easy-does-it

Garden Bench



This beauty's so simple to build, you'll be sitting pretty in no time.

Looking for a weekend project that will yield years of outdoor service? Here it is. This contoured, eye-catching bench derives its durability from rock-solid mortise-and-tenon joinery and decay-resistant cedar. It has just eight different parts, and we've included full-size curved seat-rail and support patterns for your convenience.

Better yet, you can build the bench from knotty-grade cedar posts and deck boards, yet achieve the knot-free appearance of clear-grade cedar at a fraction of the cost. To learn how, see **Shop Tip 26** from our penny-pinching Design Editor, Jeff Mertz, at *right*.

SHOPTIP 26

A low-budget way to get clear cedar

If you've tried to buy clear-grade cedar recently, you've discovered that it's a pricey, special-order item. To build this garden bench with premium stock, you would spend well over \$200, enough for most of us to say "Uncle." But, for a lot less than this cost, you can get the same unblemished look that I did using readily available knotty-grade cedar (found at home centers) and working around the knots when laying out the parts, as shown *right*. Of course, you'll need to spend a little time finding the clearest boards (it took me about 15 minutes), and you may need to buy an extra board or two for insurance, as I did. But the savings are significant.

My materials cost less than \$100, including the extra boards.

A handwritten signature in black ink, reading "Jeff".

Jeff Mertz, Design Editor



Look over your stock to find the clearest areas. Then, lay out the parts with chalk, as I'm doing here on a 4x4 post for the bench legs (A).

Start with the legs

1 From a 4x4 cedar post 8' long, cut four clear 18"-long workpieces for the legs (A). Using your jointer, square two adjacent faces on each piece. Then cut a 2¼"-square leg from each piece.

2 Mark the two best faces on each leg for the outside. Then lay out the ¾x2½" mortises on the legs' inside faces, where dimensioned on **Drawing 1**, making sure you create mirrored pairs of legs. Using a ¾" Forstner bit in your drill press and a fence to keep the holes aligned, drill the ⅞"-deep mortises. Square their sides and ends with a chisel.

SHOPTIP 27 Leave room for glue. Cut mortises ⅛" deeper than the mating tenons' length to prevent glue squeeze-out.

3 Rout ⅛" round-overs along all of the legs' edges and ends. Then sand the legs smooth using 180-grit sandpaper.

Next up: the frame parts

1 From 5/4 cedar deck boards planed to 1" thick, cut the seat rails (B), bottom side rails (C), and front/back rails (D) to size [Materials List]. Cut an extra piece with the same thickness and width for test tenons. (We planed our 1½"-thick deck boards to 1" thick by removing equal material from both faces.)

2 To form the tenons on the rails' ends, where dimensioned on **Drawing 2a**, fit your tablesaw with a ¾" dado blade, and raise the blade to ⅝". Next attach an auxiliary fence to the saw's rip fence and an auxiliary extension to the miter gauge as a backer to prevent tear-out. Position the fence so it just touches the dado blade. Now form a ¾" tenon ¾" long on the end of your test piece, as shown in **Photo A**. Test the tenon's fit in the leg (A) mortises. If necessary, adjust your setup, and retest. When you're satisfied with the fit, cut the tenons on the ends of the rails (B, C, D).

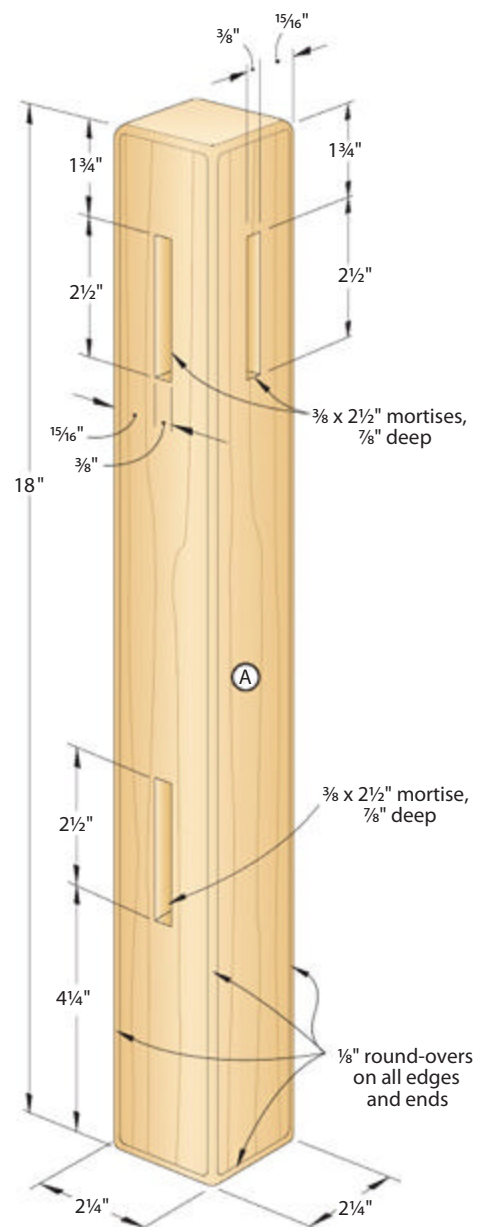
3 Raise your dado blade to ½". Crosscut both edges on your test piece to trim the tenon's width to 2½". Check its fit in the leg mortises. Adjust the blade height, if necessary, to achieve a good fit. Now trim the tenons on the rails.

4 Make four copies of the combined full-size half patterns for the seat rail (B) and seat support (F) on *page 40*. Set two of the copies aside for a seat support. Cut out and spray-adhere the remaining copies to a seat rail, aligning the applicable patterns' ends with the tenons' shoulders. (You'll need to flip one of the

patterns over to complete the contour.) Now bandsaw and sand to the pattern line. Using the rail as a template, mark the contour on the other seat rail, and cut and sand it to shape. Remove all of the paper patterns.

5 Lower your dado blade to ¼". Then, making two passes, cut a 1" dado centered on the inside face of the bottom side rails (C), where shown on **Drawing 2**. Now, cut two 1" dados ¼" deep on the inside face of the front/back rails (D), where dimensioned.

1 LEG (Left rear shown)



CUT A TEST TENON



Keeping the end of your test piece tight against the auxiliary fence, crosscut both faces to form a tenon ¾" thick.

6 Mark the center of the arches on the bottom side rails (C) and front/back rails (D), where dimensioned. Then bend a fairing stick to these points, and draw the arches. (For a free fairing stick plan, go to woodmagazine.com/fairing.) Bandsaw and sand the arches to shape.

7 Round over the edges of the rails (B, C, D), where shown. Sand parts smooth.

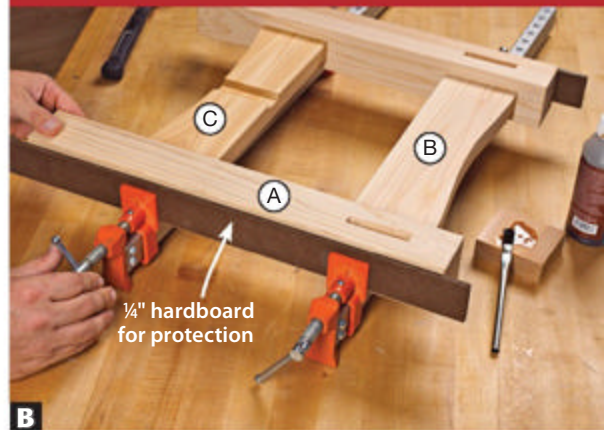
8 Cut the bench stretcher (E) and seat supports (F) to the sizes listed. Then retrieve the two copies of the seat support half-pattern, and spray-adhere them to a seat support, aligning them with the support's ends. Bandsaw and sand them to shape. Now, using this part as a template, mark the contour on the other seat support, and cut and sand

it. Remove the patterns, and sand the supports and stretcher smooth.

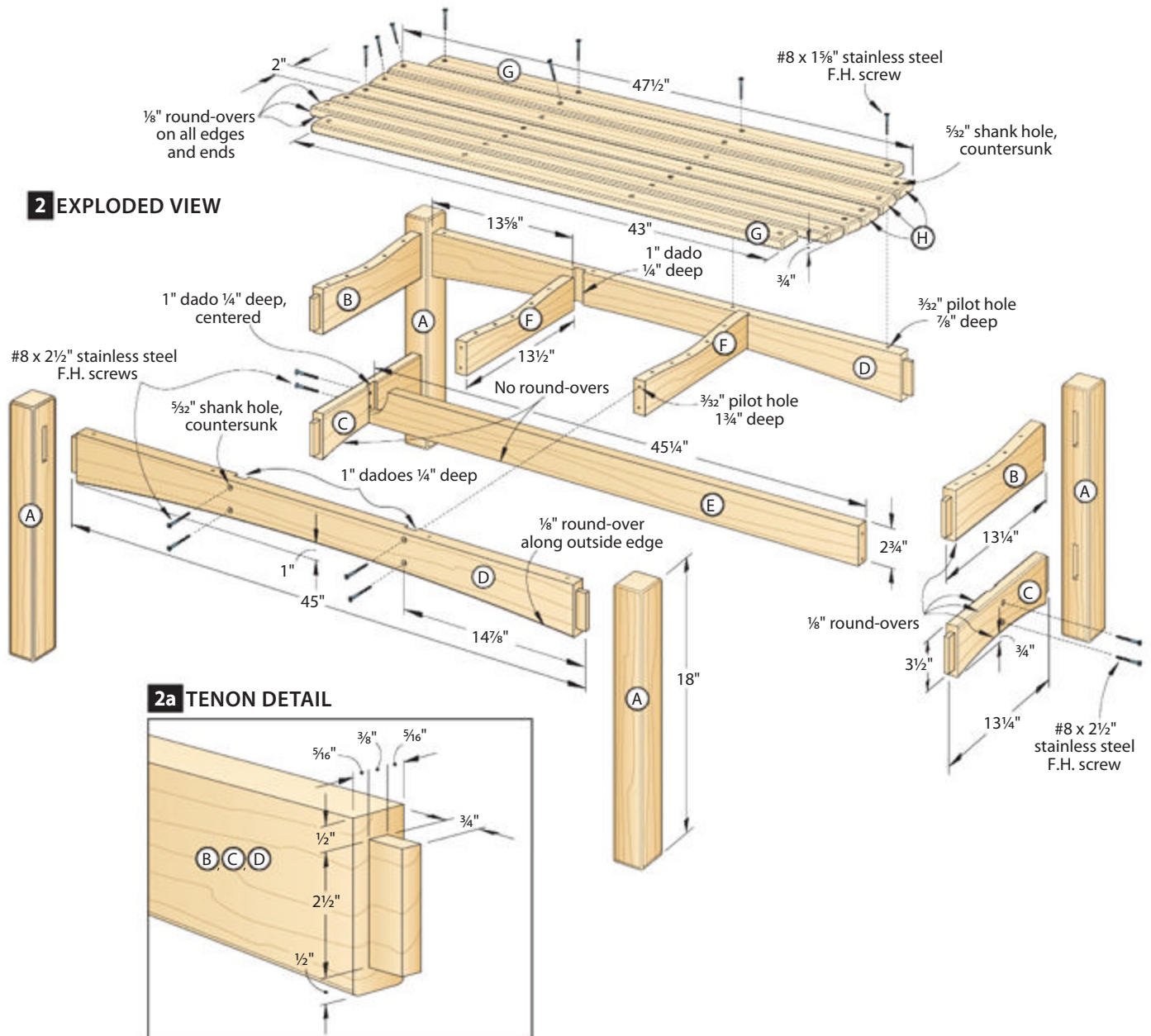
Assemble the bench frame

1 To assemble the legs (A), seat rails (B), and bottom side rails (C), first refer to **Drawing 2** for the required orientation of the parts. Then, referring to the manufacturer's instructions, apply a thin layer of polyurethane glue in the mortises of two legs, and assemble the legs, a seat rail, and a bottom side rail. Clamp the assembly together, as shown in **Photo B**. (To prevent squeeze-out, we applied glue only in the mortises.) Repeat to assemble the other two legs, seat rail, and bottom side rail.

ASSEMBLE THE ENDS



B Using scrap 1/4" hardboard strips to protect the legs (A) from marks, clamp together the legs, seat rail (B), and bottom side rail (C).



Cutting Diagram



3 1/2 x 3 1/2 x 96" Cedar (4x4) *Plane or resaw to the thicknesses listed in the Materials List.



1 1/8 x 5 1/2 x 96" Cedar (5/4x6)



1 1/8 x 5 1/2 x 96" Cedar (5/4x6)

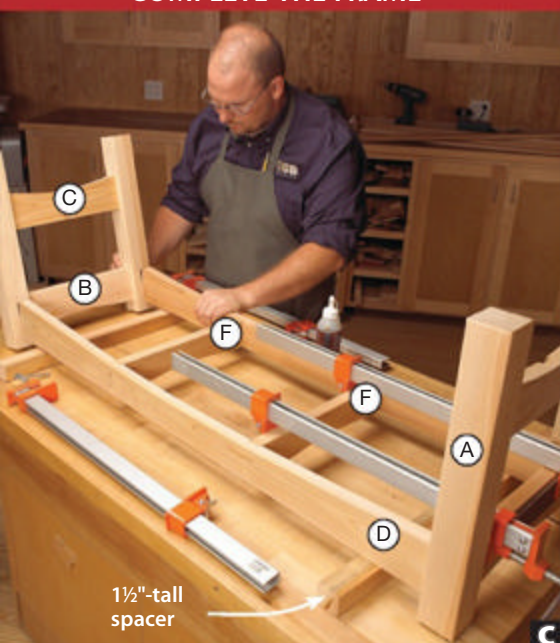


1 1/8 x 5 1/2 x 96" Cedar (5/4x6)



1 1/8 x 5 1/2 x 96" Cedar (5/4x6)

COMPLETE THE FRAME



With the seat-support assembly (D/F) on 1/2"-tall spacers, glue and clamp the end assemblies (A/B/C) to the front/back rails (D).

2 Glue and clamp the seat supports (F) between the front/back rails (D), and check for square. Then drill countersunk screw holes through the rails, centered in their dadoes, and in the supports, where shown. Drive the screws. (We bought the stainless steel flathead screws for our project from McFeely's. Go to mcfeelys.com or call 800-443-7937.) Keep the assembly on a flat surface while the glue dries.

3 Glue and then loosely clamp the end assemblies (A/B/C) to the seat-support assembly (D/F), as shown in

MOUNT THE SEAT SLATS



Using 1/4"-thick spacers and hardboard scraps to position the front/back seat slats (G) on the frame, drill the holes, and drive the screws.

Photo C. To avoid using extra-long clamps in this step, clamp the seat rails (B) to the seat supports (F), as shown. Then glue the stretcher (E) in place between the bottom side rails (C), and tighten the clamps. Drill countersunk screw holes through the bottom side rails, centered over their dadoes, and in the stretcher. Now drive the screws.

Add the slats and finish

1 Plane 5/4 cedar deck boards to 3/4" thick. Cut the front/back seat slats (G) and center seat slats (H) to size.

Materials List

Part	FINISHED SIZE			Matl.	Qty.
	T	W	L		
A legs	2 1/4"	2 1/4"	18"	C	4
B seat rails	1"	3 1/2"	13 1/4"	C	2
C bottom side rails	1"	3 1/2"	13 1/4"	C	2
D front/back rails	1"	3 1/2"	45"	C	2
E stretcher	1"	2 3/4"	45 1/4"	C	1
F seat supports	1"	2 5/8"	13 1/2"	C	2
G front/back seat slats	3/4"	2"	43"	C	2
H center seat slats	3/4"	2"	47 1/2"	C	5

Materials key: C—choice of cedar, redwood, or cypress.

Supplies: Spray adhesive, polyurethane glue, #8x2 1/2" stainless steel flathead screws (12), #8x1 3/8" stainless steel flathead screws (28).

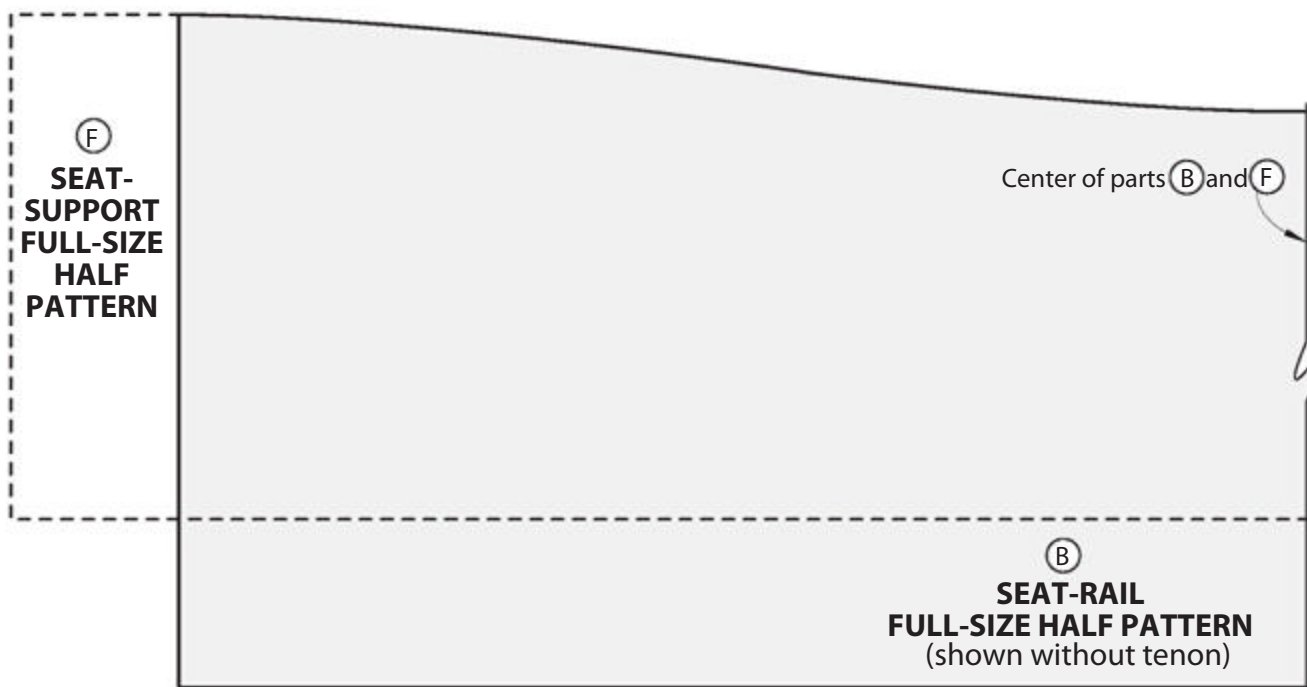
Blade and bit: Dado-blade set, 1/8" round-over router bit, 3/8" Forstner bit.

Round over the slats' edges and ends, where shown on **Drawing 2**. Then sand the slats smooth.

2 Before mounting the slats, apply a coat of waterproof oil wood sealer. (We used Behr Premium Clear Weatherproofing Wood Sealer & Finish.)

SHOPTIP 28 Leg soak for sealer. To give the bottoms of the legs extra protection, soak them in sealer in a disposable pie pan.

3 When the sealer dries, position the front/back seat slats (G) on the bench frame with their ends 1/4" from the legs (A) and their inside edges flush with the legs' inside faces, as shown in **Photo D**. Then drill countersunk screw holes through the slats and into the front/back rails (D), where shown on **Drawing 2**, and drive the screws.



4 Position the center seat slats (H) on the bench frame, inserting $\frac{1}{4}$ "-thick spacers (not hardboard) between them and the front/back seat slats (G). Center the seat slats so they overhang the seat rails (B) $\frac{3}{8}$ " at each end. Make any adjustments needed for uniform spacing. Then drill countersunk screw holes through the seat slats and into the seat rails and seat supports (F), where shown, and drive the screws. Now move the bench to your garden, and take some time to smell the roses. 🌹

Written by **Owen Duvall**
Project design: **Jeff Mertz**
Illustrations: **Roxanne LeMoine**

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SHOPTIPS 29, 30, 31 & 32

Softwood savvy times 4

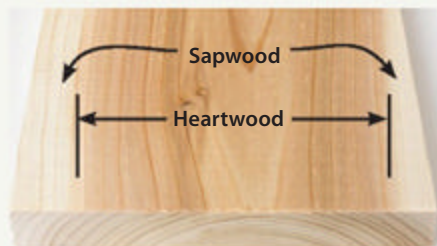
● **Avoid sapwood.** It's generally not decay resistant. Almost always it appears as the lighter material in a given piece of lumber, as shown at *right*.

● **Use quartersawn lumber.**

Quartersawn wood resists warping better than flatsawn lumber. Also, quartersawn wood expands and contracts across its width only about half as much as flatsawn lumber. (See the examples at *right*.) Although such wood can sometimes be difficult to find, you can usually create it by buying wide boards (more than twice as wide as you need) and cutting out the unstable pith wood center (the innermost rings).

● **Look for tight-grain lumber.** Such dense pieces are more stable, making them less prone to cracking, cupping, warping, and shelling (see next tip) than wide-grain stock. See photos at *right*.

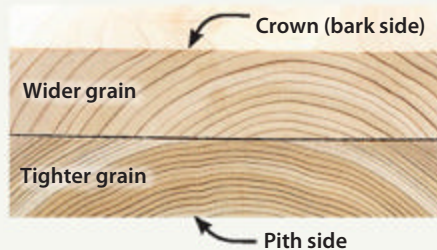
● **Place horizontal boards crown up.** If you can't avoid flatsawn (also called plainsawn) lumber, placing the crown up will help shed water and reduce the effects of shelling. Shelling occurs when the bands of earlywood (lighter wood grain) and latewood (darker wood grain) separate. It occurs on the pith side of a board rather than the bark (crown) side. See the photo at *right* for reference.



Sapwood, seen here as the lighter portions of this board, offers the least resistance to decay. It borders the darker heartwood.



A flatsawn board (top) expands twice as much across its width as a quartersawn one, leading to less stability.



Choose tighter-grain wood (bottom) over wider-grain material for maximum stability.

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build-in-a-weekend **Bookcase**

Solid wood and simple moldings make a fitting home for books and collectibles.



You'll love the traditional styling and no-nonsense construction of this project. To help speed the bookcase through your shop, we've sourced mail-order feet. But, should you want to turn your own feet, we've included a full-size pattern on *page 47*. You can give the bookshelf a touch of your own personal style by simply choosing a different foot and routing a different profile on the face-frame stiles. (See *page 47* for a few options.)

Start with the case

1 From $\frac{3}{4}$ "-thick stock, edge-join over-size blanks for the sides (A), top and bottom (B), cap (C), and shelves (D). Sand the blanks smooth and cut them to the sizes listed on the **Materials List**.

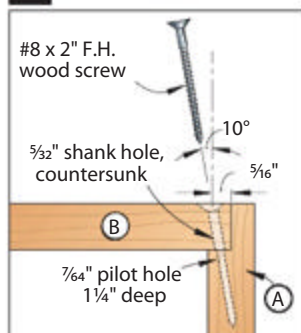
2 With a dado blade in your tablesaw, cut $\frac{3}{4}$ " rabbets $\frac{3}{8}$ " deep in the ends of the sides (A), where shown on **Drawing 1**. Then cut a $\frac{1}{4}$ " rabbet $\frac{3}{8}$ " deep along each inside back edge. Now lay out the shelf-

support hole centers where dimensioned, and using a $\frac{1}{4}$ " brad-point bit with a depth stop, drill $\frac{3}{8}$ "-deep holes. Finish-sand the sides and the top and bottom (B).

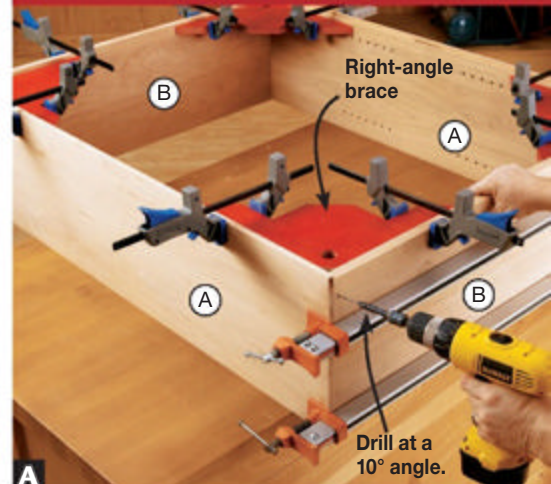
3 Glue and clamp together the sides (A) and top and bottom (B), in the configuration shown on **Drawing 2**. Use shop-made plywood right-angle braces to keep the assembly square. (To obtain a free plan for the plywood right-angle braces, go to woodmagazine.com/brace.)

Then reinforce the joints with screws, where shown on **Drawings 2** and **2a** and as shown in **Photo A**. (Screws will hold the case together until the glue dries.)

2a CASE CORNER DETAIL



SCREWS REINFORCE CORNERS

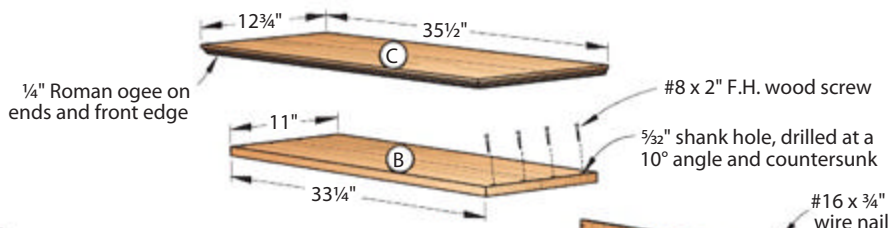


A Drill angled screw holes $\frac{5}{16}$ " from the ends of the top and bottom (B) into the sides (A). Then drive the screws.

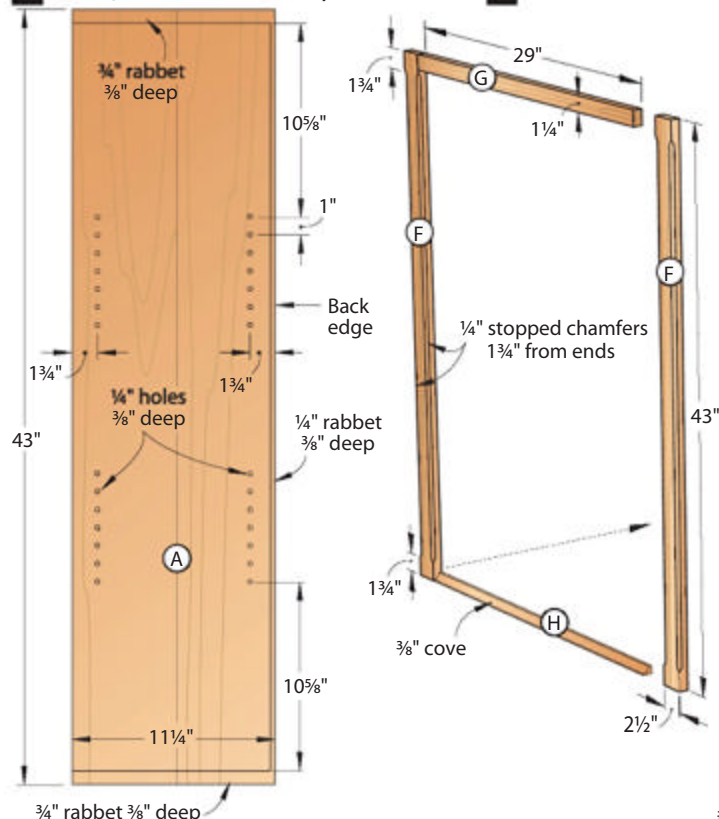
PROJECT HIGHLIGHTS

Overall dimensions:

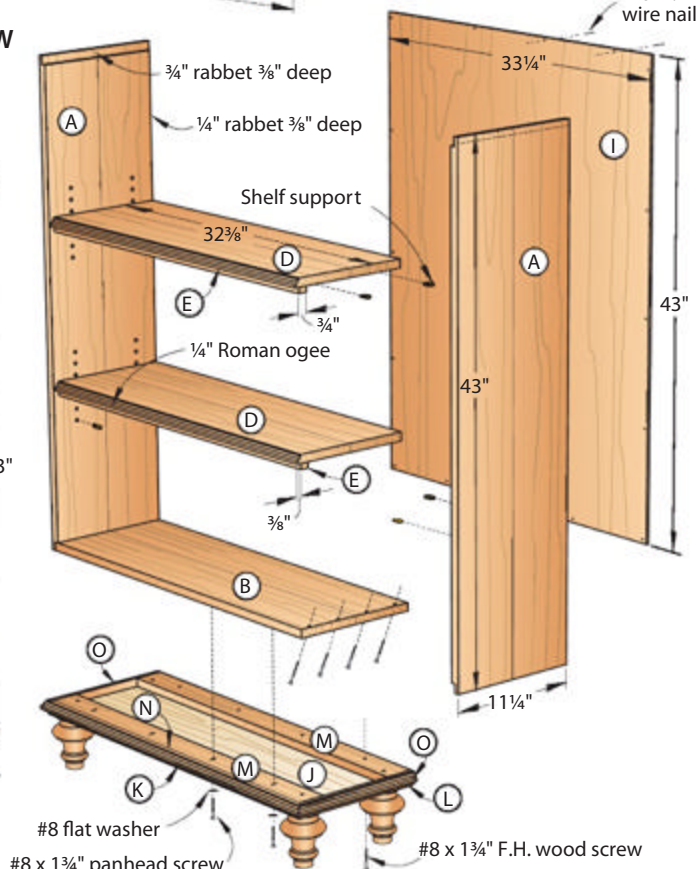
- $35\frac{1}{2}$ " wide x $12\frac{3}{4}$ " deep x 50" high
- For the board feet of lumber and other items needed to build this project, see *page 46*.



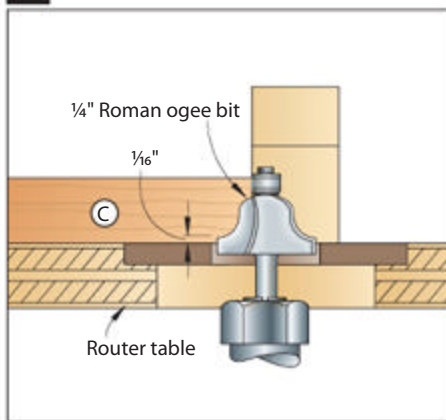
1 SIDE (Inside face shown)



2 EXPLODED VIEW



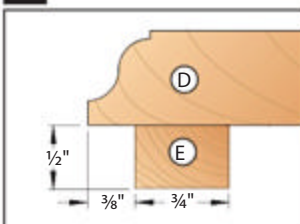
2b ROMAN OGEE DETAIL



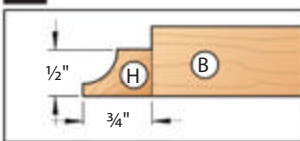
4 Retrieve the cap (C). Chuck a 1/4" Roman ogee bit into your table-mounted router. Then rout the profile shown on **Drawing 2b** along the ends and front edge. Finish-sand the cap and glue and clamp it to the top (B), flush with the back edges of the sides (A) and centered side-to-side.

5 Retrieve the shelves (D) and rout a 1/4" Roman ogee profile along the top front edges, where shown on **Drawing 2**. Then cut the shelf rails (E) to size. Keeping the ends flush, glue and clamp the rails to the shelves, where shown on

2c SHELF DETAIL



2d COVE DETAIL



Drawing 2c. Now finish-sand the two cherry shelves.

6 Cut the stiles (F) to size. To rout the stopped chamfers, where shown on **Drawing 2**, see **Shop Tip 33** below.

7 Glue and clamp the stiles (F) to the sides (A), keeping the outside edges flush. Check the distance between the stiles, and cut the rail (G) to size. Then glue and clamp the rail to the top (B). Finish-sand the stiles and rail.

8 For the cove (H), cut a 3/4x2 1/2x36" blank and plane it to 1/2" thick. Chuck a 3/8" cove bit into your table-mounted

router and rout one edge of the blank. Do not change the router-table setup. Using your tablesaw, rip the 1/2"-thick cove from the edge of the blank. Set aside the rest of the blank for parts K and L. Check the distance between the 2 1/2"-wide stiles (F), and cut the cove to length. Then finish-sand the cove and glue and clamp it to the front edge of the bottom (B) with the bottom edges flush, where shown on **Drawing 2d**.

9 Cut the back (I) to size, finish-sand it, and set it aside.

Now make the base

1 From 1/2" birch plywood, cut the base panel (J) to size.

2 Retrieve the 1/2"-thick blank left from making part H and rip two 1/2"-wide strips from it. Miter-cut one strip to length for the front cove (K) and glue and clamp it to the front of the base panel (J), where shown on **Drawing 3**. Cut the other strip in half for the side coves (L) and miter one end of each piece. Dry-fit the side coves and mark the lengths flush with the back edge of the base panel. Then cut the coves to length and glue and clamp them in

SHOPTIP 33

Forming stopped chamfers on your router table

Using stopblocks clamped to a standard router-table fence to rout the stopped chamfers on the stiles (F) would require an auxiliary fence almost 8' long. Here's a way that uses your regular fence and no stopblocks at all.

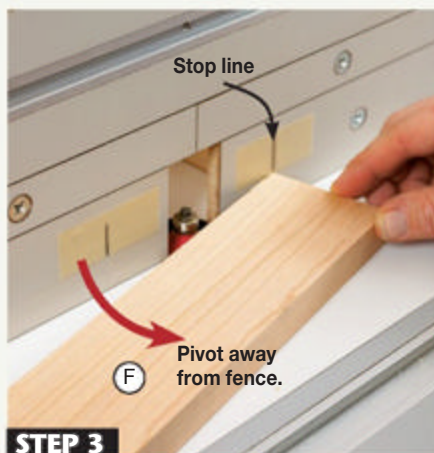
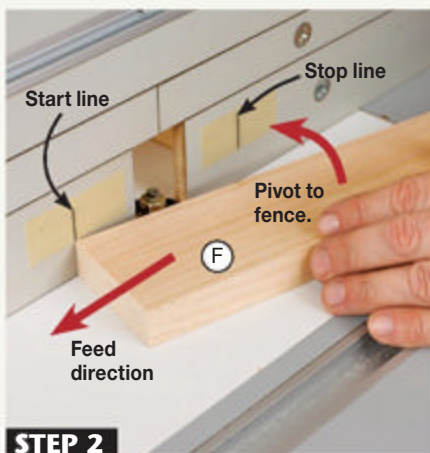
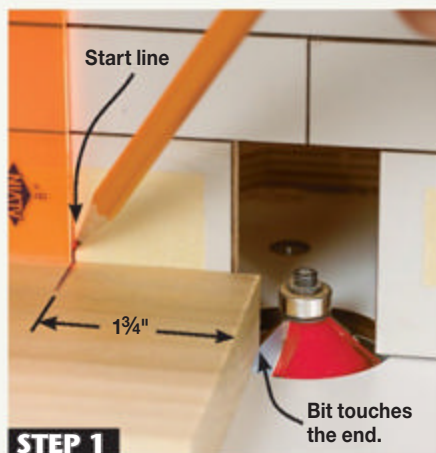
With your table-mounted router unplugged, chuck in a 45° chamfer bit and adjust it to rout a 1/4" chamfer.

Then make a mark at the edge of a piece of scrap 1 3/4" from the end.

Turning the bit by hand, position the scrap so the bit touches the end. Mark a start line on the fence to the left of the bit, as shown in **Step 1**. Repeat the process to mark a stop line to the right.

Plug in the router, and start it. Hold the stile (F) with one corner on the start

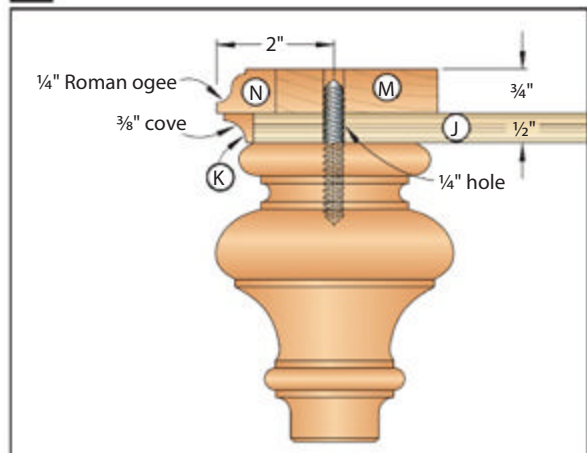
line and angled away from the fence, as shown in **Step 2**. Pivot the stile against the fence and feed it to the left. Continue routing the stile until the trailing end aligns with the stop line. Holding the corner against the line, pivot the stile away from the fence, as shown in **Step 3**. Repeat on the other edge and other stile.



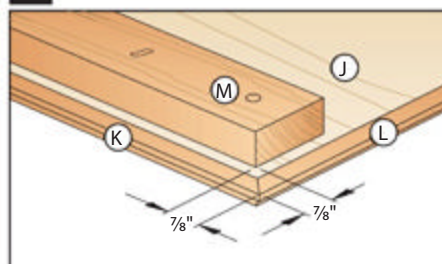
3 Cut the fillers (M) to size. Glue and clamp them to the base-panel assembly (J/K/L), centered side-to-side with the front spacer $\frac{7}{8}$ " back from the front edge, where shown on **Drawing 3a**, and the rear spacer flush at the back.

4 Cut a $\frac{3}{4} \times 2\frac{1}{2} \times 37"$ blank for the front ogee (N) and side ogees (O). Chuck a $\frac{1}{4}"$ Roman ogee bit into your table-mounted router and adjust it to cut the profile shown on **Drawing 2b**. Rout both edges of the blank, and then rip one 1"-wide ogee molding from each edge. Next miter-cut one piece to length for the front ogee and glue and clamp it in place. Now cut the other piece in half for the side ogees, and miter one end of each

5 Drill $\frac{1}{4}$ " holes through the fillers (M) and base panel (J) for mounting the feet, where shown on **Drawings 3** and **3b**. (See **Sources** on *page 46* for the turned feet.) Then, for later mounting the base to the case, drill screw holes, counter-sunk on the bottom, through the rear filler and base panel, and form $\frac{3}{16}$ " slots $\frac{3}{4}$ " long in the front filler and base panel, where shown.



3a BASE FILLER DETAIL



SHOPTIP 34

For easy finishing, take your legs for a spin



B With the drill press running at 450 rpm, sand the feet with a progression of 120-, 150-, and 220-grit sandpaper.



C Turning the drill-press chuck by hand, apply stain with a brush. Then remove most of the excess stain with a paper towel.



D With the drill press running, use a paper towel to finish wiping the stain. Remove the feet from the chuck and set them aside to dry.

On to the finish

1 To stain the turned feet (we used Zar Modern Walnut), first wrap the protruding dowel screw with a couple of layers of masking tape. Then one at a time, chuck them into your drill press and refer to **Shop Tip 34** above.

2 Check all the parts and finish-sand any areas that need it. Then apply stain and let the parts dry for 24 hours.

Apply a clear finish. (We sprayed on three coats of water-based satin polyurethane and sanded between coats with 220-grit sandpaper.)

3 Nail the back to the case with #16×¾" wire nails. Then lay the case, back down, on your workbench and clamp the base to it, flush at the back and centered side-to-side. Using the screw holes and the centers of the slots in the base as

guides, drill pilot holes in the bottom (B). Fasten the base to the case with #8×1¾" flathead wood screws at the back and #8×1¾" panhead screws and #8 flat washers at the front [**Drawing 2**].

Materials List

Part	FINISHED SIZE			Matl.	Qty.
	T	W	L		
Case					
A* sides	¾"	11¼"	43"	EC	2
B* top and bottom	¾"	11"	33¼"	EC	2
C* cap	¾"	12¾"	35½"	EC	1
D* shelves	¾"	10⅞"	32⅝"	EC	2
E shelf rails	¾"	½"	32⅝"	C	2
F stiles	¾"	2½"	43"	C	2
G rail	¾"	1¼"	29"	C	1
H* cove	½"	¾"	29"	C	1
I back	¼"	33¼"	43	CP	1
Base					
J base panel	½"	12⅞"	34¼"	BP	1
K* front cove	½"	½"	35¼"	C	1
L* side coves	½"	½"	12⅝"	C	2
M fillers	¾"	2¾"	33½"	C	2
N* front ogee	¾"	1"	35½"	C	1
O* side ogee	¾"	1"	12¾"	C	2

*Parts initially cut oversize. See the instructions.

Materials key: EC—edge-joined cherry, C—cherry, CP—cherry plywood, BP—birch plywood.

Supplies: #8×1¾", #8×2 flathead wood screws; #8×1¾" panhead screws; #8 flat washers; #16×¾" wire nails; ¼" shelf supports.

Blade and bits: Stacked dado set; ¼" brad-point drill bit; 45° chamfer, ⅜" cove, ¼" Roman ogee router bits.

Sources

Feet. 5" cherry feet with dowel screws, no. AO556-DS5 (4). Adams Wood Products. For a current price and to order, go to adamswoodproducts.com or call 423-587-2942.

Sources for foot styles shown on page 47

• Osborne Wood Products, 800-849-8876, osbornewood.com.

• Van Dyke's Restorers, 800-558-1234, vandykes.com.

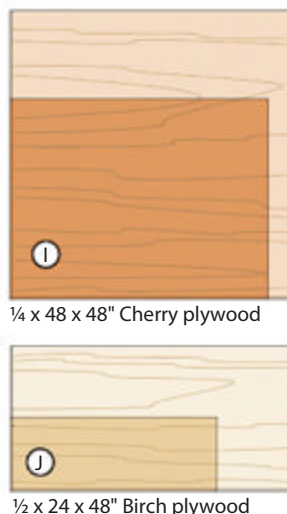
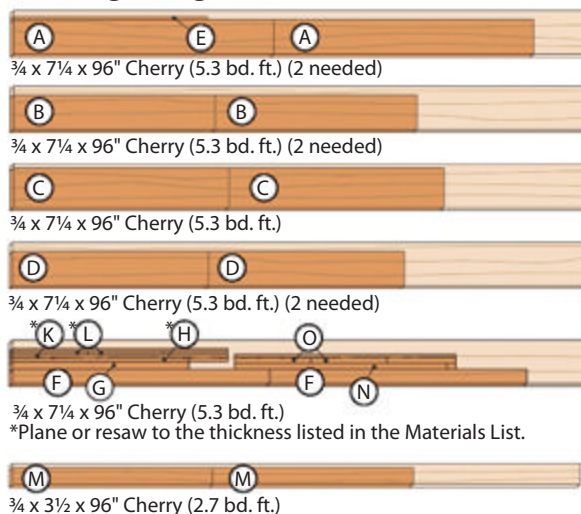
SHOPTIP 35

No-mar installation solution

When screwing the feet into the base, getting a good grip and adequate leverage on them can be difficult. To solve both problems without marring the finish, wrap the feet with a rag and turn them with a strap wrench, as shown at *right*. We purchased a plastic-handled two-wrench set at a home center for \$10.



Cutting Diagram

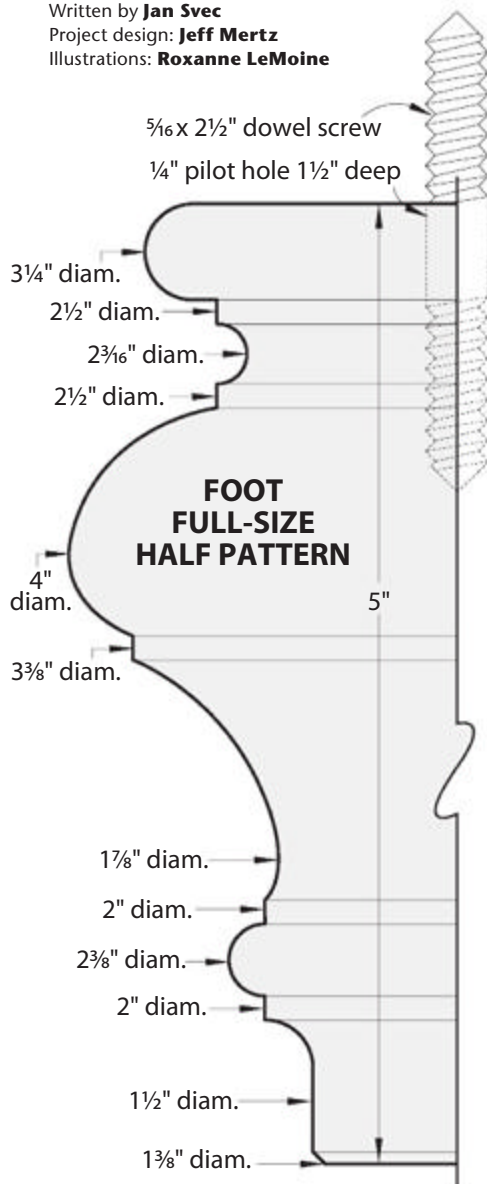


4 Turning the feet by hand, screw them into the base. For help installing them, see **Shop Tip 35** *previous page*.

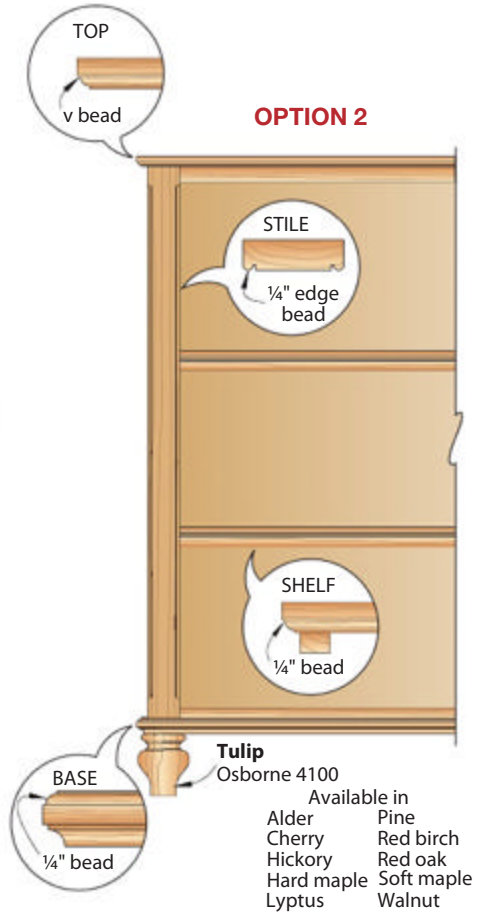
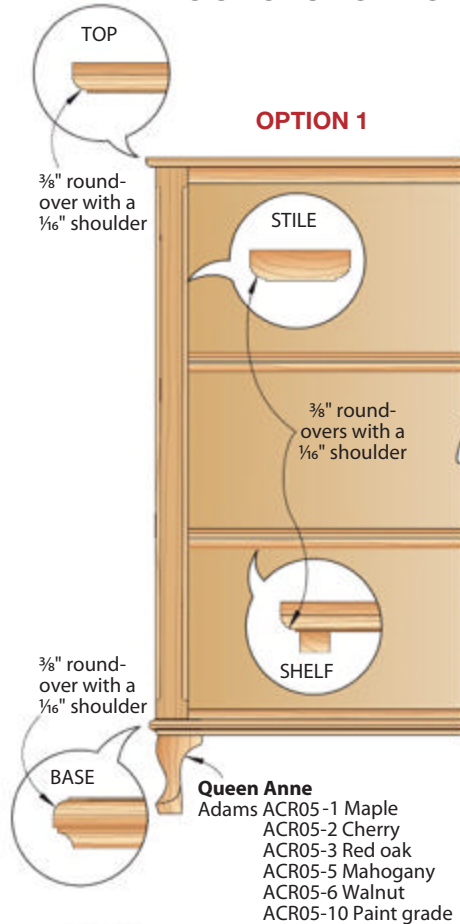
4 easy design options

It's amazing how you can completely alter the appearance of a project with out changing dimensions or construction methods. We drew up different combinations of stile treatments, routed edges, and foot profiles for the bookcase, and came up with the new looks shown at *right*. Changing some of these features amounts to little more than choosing a different router bit. And with ready-made legs, like the ones shown, you have lots of options. The ones here show only a few possibilities. 📌

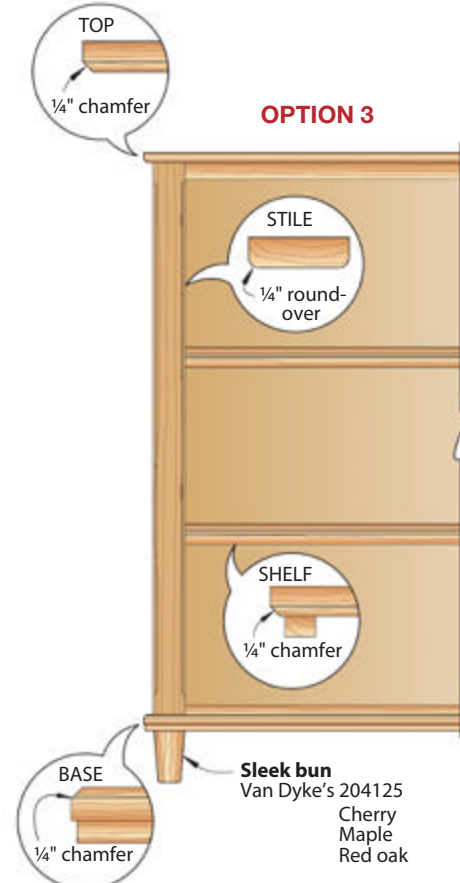
Written by **Jan Svec**
Project design: **Jeff Mertz**
Illustrations: **Roxanne LeMoine**



BOOKCASE OPTIONS



See Sources on page 46 for purchasing information.



Stack-n-Store Bins

Clean up the clutter in a garage, entryway, or kid's room with this stacking organizer. You can build all three bins in a weekend, thanks to the simple biscuit-and-screw joinery.



The bins stack and align in a jiffy. They easily screw together from the inside for stability.



PROJECT HIGHLIGHTS

- Overall dimensions are 31 $\frac{1}{8}$ " wide × 12 $\frac{3}{4}$ " deep × 36 $\frac{3}{4}$ " high.
- Materials needed: You can **build a trio of bins** from one 4×8 sheet of $\frac{3}{4}$ "-thick medium-density fiberboard, a half-sheet of $\frac{1}{4}$ " hardboard, and a small piece of poplar, **for around \$35**.
- Need more storage? You can stack up to six bins. When doing this, make sure you secure the unit to the wall studs with an anti-tip safety-cable kit (available at your local home center).

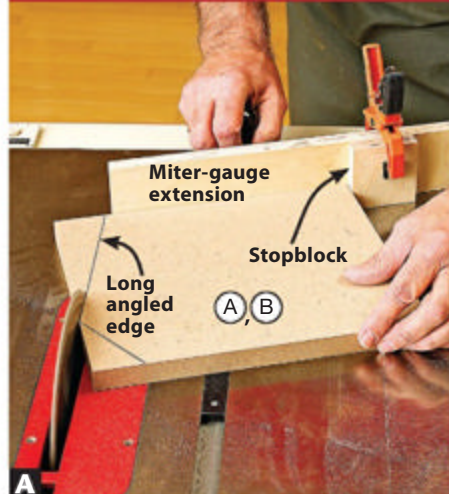
Skill Builder

- Learn how to safely and accurately plunge slots in the edges and faces of parts with your biscuit joiner.

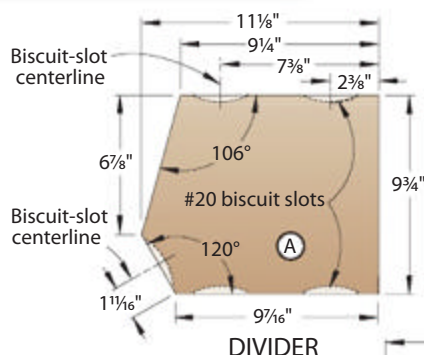
Start with the MDF parts

1 From $\frac{3}{4}$ " medium-density fiberboard (MDF), cut the dividers (A), ends (B), tops/bottoms (C), and fronts (D) to the sizes listed [Materials List, page 51]. To get all of the parts for the three bins from a 4×8 sheet of MDF, see the **Cutting Diagram**, page 51.

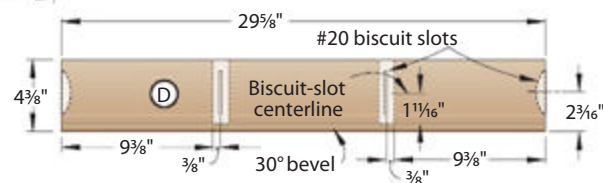
MITER-CUT THE DIVIDERS AND ENDS



Angle your miter gauge to align the blade with the layout lines on the dividers (A) and ends (B), and miter-cut the parts to shape.

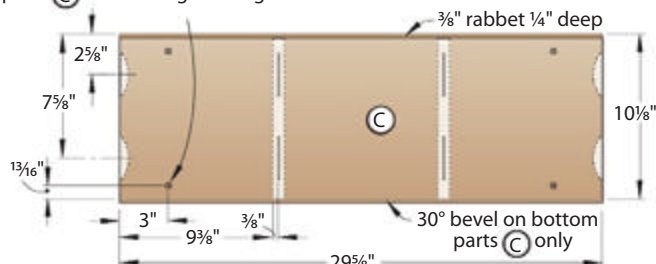


DIVIDER



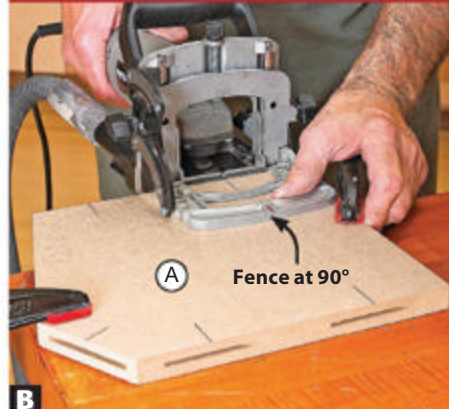
FRONT
(Inside face shown)

Countersunk shank hole, in two top parts (C) for securing bins together.

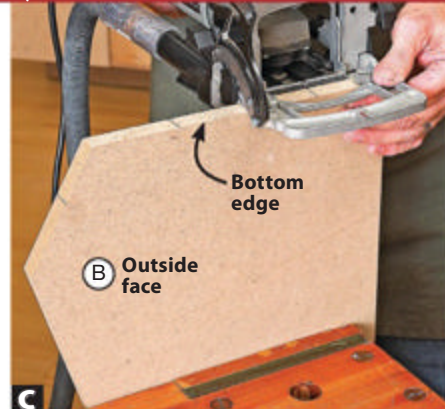


TOP/BOTTOM
(Inside face shown)

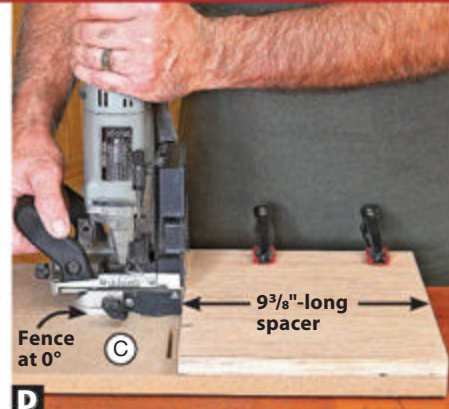
WITH THE PARTS SECURED FOR SAFETY, PLUNGE THE BISCUIT SLOTS IN THE EDGES AND FACES



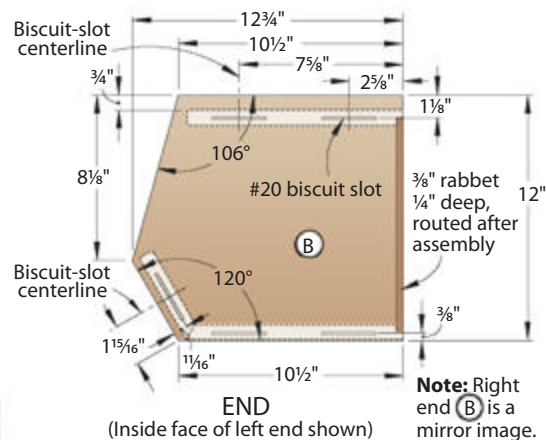
Plunge slots centered in the *edges* of the dividers (A), tops/bottoms (C), and fronts (D) at the marked centerlines.



Adjust the fence height as needed, and plunge the slots in the *inside faces* of the ends (B) at the marked lines.



Using a spacer at each end of the tops/bottoms (C) and fronts (D), position the biscuit joiner, and plunge the slots in the *inside faces*.



Note: Right end (B) is a mirror image.

1 PARTS VIEW

2 Lay out the angles on the front edges of a divider (A) and an end (B), where dimensioned [Drawing 1]. (The angles are the same on both parts, but the locations are different.) Attach an extension with a stopblock to your tablesaw miter gauge. Angle the gauge to align the blade with the layout line for the *long* angled edge on the divider, and position the stopblock against the divider. Miter-cut the dividers [Photo A].

Without changing the miter-gauge angle, reposition the stopblock to align the blade with the layout line for the *long* angled edge on the end (B). Cut the ends. Using the same process, miter-cut the *short* angled edges on the dividers and ends. You'll need to rotate the miter gauge in the opposite direction to make these cuts.

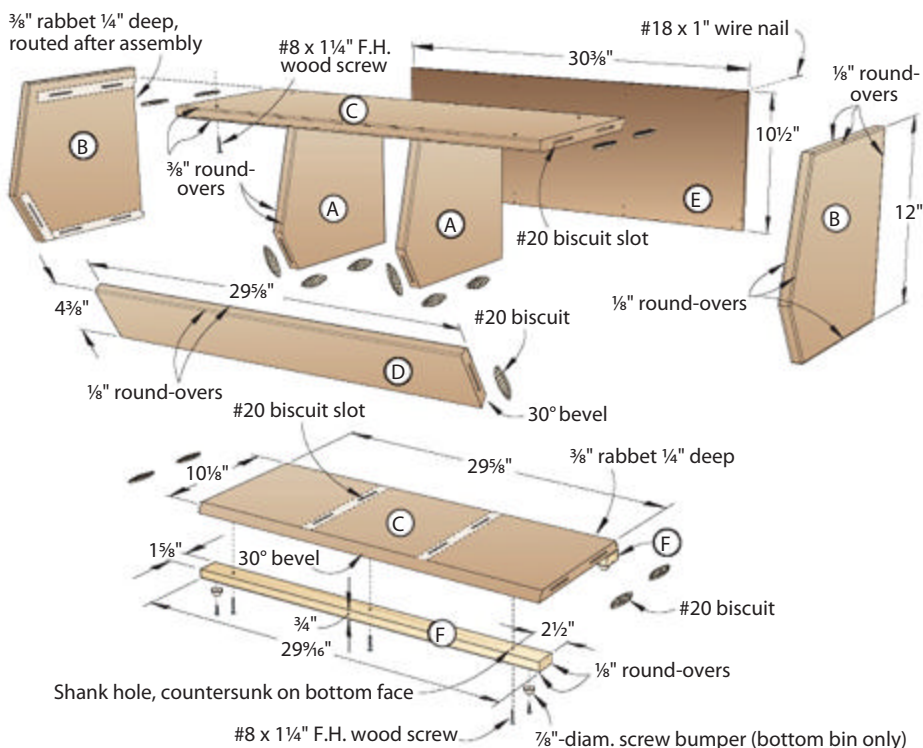
3 Draw centerlines for #20 biscuit slots on parts A through D where dimensioned [Drawing 1], making sure that you mark the *inside* faces of the ends (B) to create mirror-image parts. Then plunge the slots in the parts [Photos B, C, and D].

4 Angle your tablesaw blade 30° from vertical. With the *inside* faces down, bevel-rip the *front* edges of the bottoms (C) and one edge of the fronts (D) [Drawings 1 and 2], making sure that you do not change the finished widths.

5 Rout 1/8" round-overs along the edges of the dividers (A), ends (B), and fronts (D), where shown [Drawing 2].

6 Rout a 3/8" rabbet 1/4" deep along the *back* edges of the tops/bottoms (C) on the *inside* faces to receive the 1/4" hardboard backs (E) [Drawings 1 and 2]. You'll rout the rabbets in the ends (B) after assembling the bins.

2 EXPLODED VIEW



7 To secure the bins together when stacked, mark centerpoints for mounting holes on the *inside* faces of two tops (C), where dimensioned [Drawing 1]. Drill the countersunk shank holes.

Assemble the bins

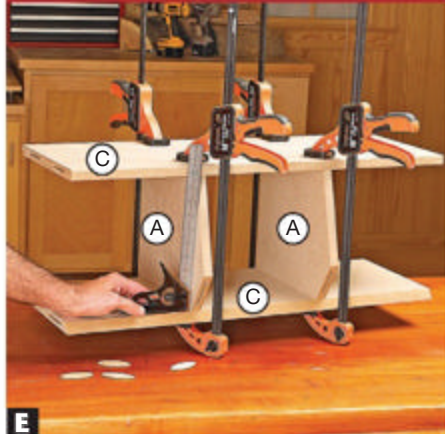
1 Glue, biscuit, and clamp together the dividers (A) and top/bottom (C) for each bin [Drawing 2, Photo E]. Then glue and biscuit the front (D) to each bin [Photo F]. Now add the ends (B) [Photo G].

2 Using your rabbeting bit, rout a 3/8" rabbet 1/4" deep along the *inside back* edges of the ends (B), as explained in **Shop Tip 36**, next page, to complete the openings for the backs (E). Now square the corners with a chisel.

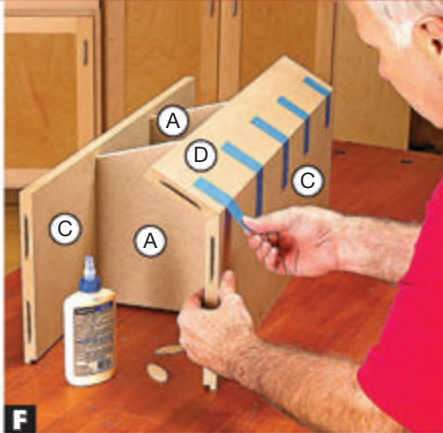
3 Measure the openings for the backs (E). Then cut them to size, and set aside.

4 Cut the cleats (F) to size. Note that the 29 5/8"-long cleats are 1/16" shorter than the bottoms (C) to provide clearance for the cleats to fit between the ends (B) when stacking the bins. Rout 1/8"

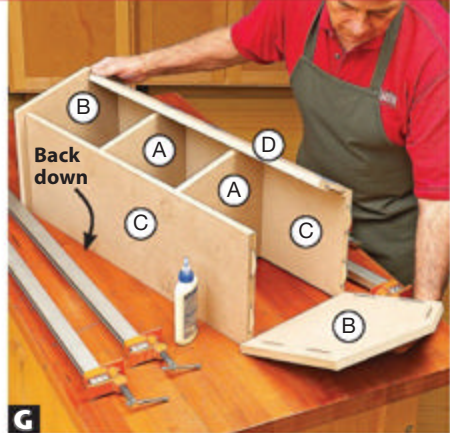
BISCUIT THE BINS TOGETHER IN 3 EASY STAGES



E Using #20 biscuits, glue and clamp the dividers (A) and top/bottom (C) of each bin together. Check the assembly for square.



F Glue and biscuit the front (D) to the dividers (A) and bottom (C) of each bin. Draw the beveled front/bottom joint tightly with tape.



G Position each bin with the back down. Then glue, biscuit, and clamp the ends (B) to the top/bottom (C) and front (D).

round-overs along the bottom edges [Drawing 2] of the cleats. Then drill three countersunk shank holes through each cleat on the bottom face, where dimensioned. Sand the cleats to 150 grit. Now glue and screw a pair of cleats to the bottom of each bin, aligning the cleats with the front and back edges [Drawings 2 and 3] and centering them end to end.

Time to finish up

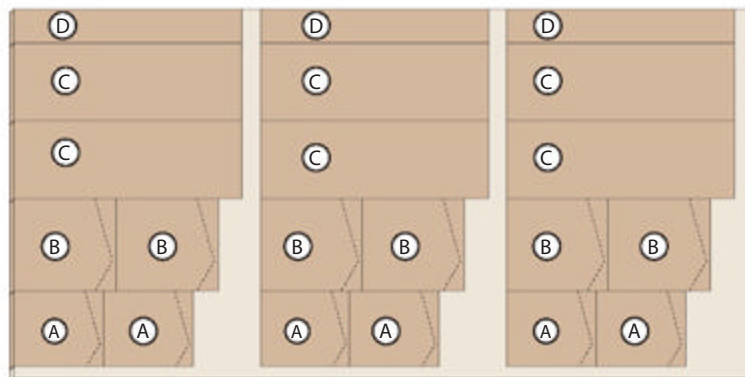
1 Sand any areas of the bins that need it to 150 grit. Remove the dust.

2 Prime and paint the bins a color of your choice, or apply a clear protective finish. (We applied Behr Premium Plus Enamel Undercoater Primer & Sealer, followed by two coats of Kitchen & Bath Interior Sateen Lustre Enamel, color: Chestnut Stallion.)

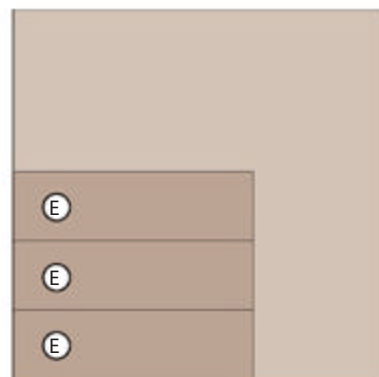
3 Attach the backs (E) to the bins using #18×1" wire nails [Drawing 2]. Then drill pilot holes and mount the 7/8"-diameter screw bumpers to the cleats (F) of one bin only for the bottom [Drawings 2 and 3].

4 Finally stack the bins in the desired location, keeping the backs flush

Cutting Diagram



¾ x 48 x 96" Medium-density fiberboard



¼ x 48 x 48" Hardboard



¾ x 3½ x 96" Poplar

SHOP TIP 36

How to safely rout along a narrow edge

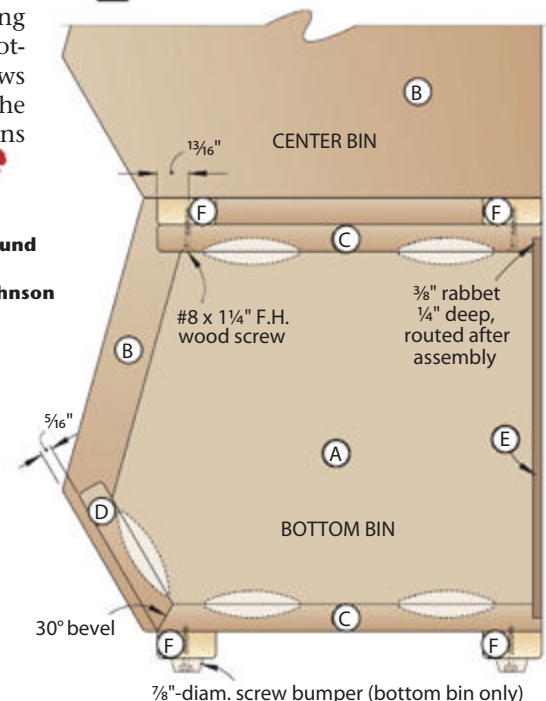
Here's a simple way to support your router when machining along the edge of a part, such as for rabbeting the ends (B) after assembly to receive the backs (E). Clamp a 1½"-wide scrap (a 2×2 works great) of the needed length to the part, flush with the edge, as shown. The scrap provides sufficient bearing surface, so you can keep the router stable and make a straight cut.



and making sure that the bin that has the top (C) *without* mounting holes is on top. From inside the bottom two bins, drive #8×1¼" screws through the mounting holes in the tops into the cleats (F) of the bins above. Now start fillin' the bins. 📌

Written by **Owen Duvall** with **Chuck Hedlund**
Project design: **Jeff Mertz**
Illustrations: **Roxanne LeMoine; Lorna Johnson**

3 SIDE SECTION VIEW



Materials List (3 bins)

Part		FINISHED SIZE			Matl.	Qty.
		T	W	L		
A	dividers	¾"	9¾"	11⅞"	MDF	6
B	ends	¾"	12"	12¾"	MDF	6
C	tops/bottoms	¾"	10⅞"	29⅝"	MDF	6
D	fronts	¾"	4⅜"	29⅝"	MDF	3
E	backs	¼"	10½"	30⅜"	H	3
F	cleats	¾"	1⅝"	29⅞"	P	6

Materials key: MDF—medium-density fiberboard, H—hardboard, P—poplar.

Supplies: #20 biscuits, #8×1¼" flathead wood screws, #18×1" wire nails, 7/8"-diameter screw bumpers (4), anti-tip kit safety cable (when stacking more than three bins).

Bits: ⅛" and 3/8" round-over and 3/8" rabbeting router bits.

Find more storage
and shelving plans at:
woodmagazine.com/storage



buttoned-up

Picture Frame

Riftsawn grain and ebonized square "pegs" for your favorite 8x10" photo

What appear to be fussy mortise-and-tenon joints pinned with pyramid-shaped square pegs are actually easy-to-build half-laps adorned with decorative shop-made buttons. Don't worry about searching for expensive straight-grained lumber either. We'll show you how to obtain this stock from ordinary fir boards, and how to accent it with ebonized buttons you can make yourself.

Make a frame and buttons

1 From $\frac{3}{4}$ " stock, cut the stiles (A) to size [Materials List]. (We used riftsawn Douglas fir. To obtain riftsawn stock, see **Shop Tip 38** on page 54.

With a $\frac{3}{4}$ " dado blade in your tablesaw, cut $1\frac{3}{4}$ " dados $\frac{1}{2}$ " deep, [Drawing 1].

SHOPTIP 37 *Cut clean lap joints. Because the lap joints are exposed at the frame sides, you'll need a high-quality stacked dado set to cut smooth-bottomed dados to ensure tight*

glue lines. To prevent chip-out, back the cuts with an extension attached to your tablesaw miter gauge.

Finish-sand the stiles.

2 For the rails (B), plane a $\frac{3}{4}$ ×2×24" piece of stock to $\frac{3}{8}$ " thick, and cut the parts to length. Adjust the dado blade in your tablesaw to cut $\frac{1}{8}$ " deep, and cut three-sided tenons on the rail ends, where shown on **Drawing 1a**. Then finish-sand the rails.

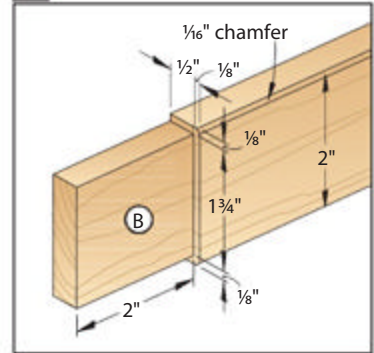


To hang the frame on a wall, simply omit the stand-up leg and add a sawtooth hanger.

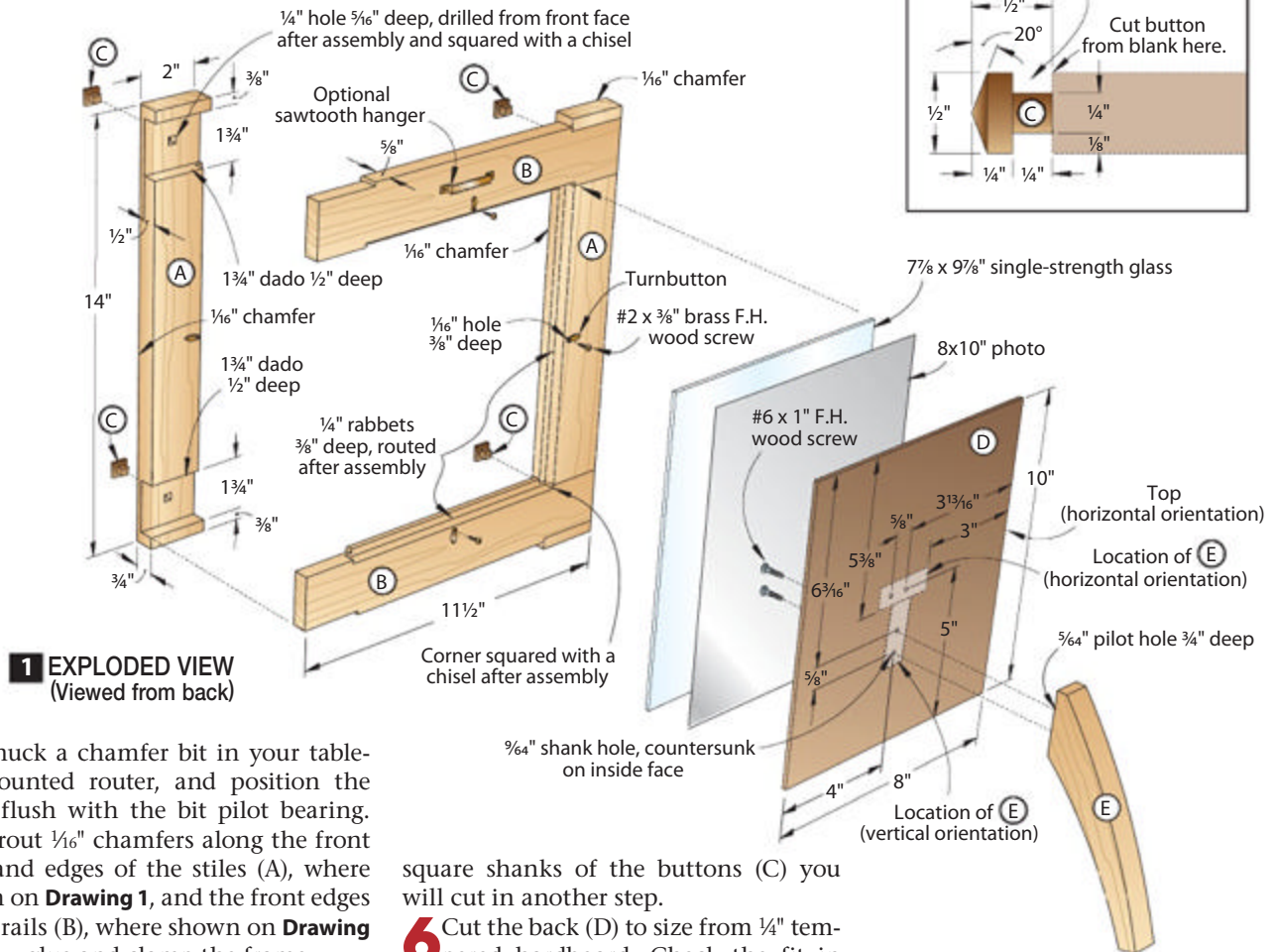
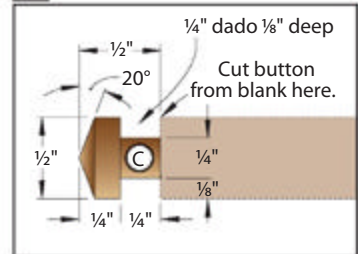


Turnbuttons, a flush hardboard back, and a wood leg give the back a finished look.

1a RAIL DETAIL (Viewed from front)



1b BUTTONS (4 needed)



1 EXPLODED VIEW (Viewed from back)

3 Chuck a chamfer bit in your table-mounted router, and position the fence flush with the bit pilot bearing. Then rout $\frac{1}{16}$ " chamfers along the front ends and edges of the stiles (A), where shown on **Drawing 1**, and the front edges of the rails (B), where shown on **Drawing 1a**. Now glue and clamp the frame.

4 With the glue dry, chuck a $\frac{1}{4}$ " rabbeting bit in your table-mounted router, and rout a $\frac{3}{8}$ "-deep rabbet along the frame inside rear edges, where shown on **Drawing 1**. Then square the rabbeted corners with a chisel.

5 Chuck a $\frac{1}{4}$ " brad-point bit in your drill press and drill $\frac{5}{16}$ "-deep holes at each corner, centered on *both* the frame stiles (A) and rails (B) [**Drawing 1**]. Square the holes with a $\frac{1}{4}$ " chisel to accept the

square shanks of the buttons (C) you will cut in another step.

6 Cut the back (D) to size from $\frac{1}{4}$ " tempered hardboard. Check the fit in the frame rabbeted opening. You may have to joint one end and edge for a snug fit. Drill two countersunk shank holes for attaching the leg (E) [**Drawing 1**]. (Omit the holes for a hanging frame.)

7 Cut the leg blank (E) to size. (Omit the leg for a hanging frame.) Make a photocopy of the **Leg Pattern** on *page 54* and adhere it to the blank with spray adhesive. Bandsaw and sand the leg to shape. Adhere the leg to the back (D)

with double-faced tape, where shown [**Drawing 1**]. Using the shank holes in the back as guides, drill pilot holes in the leg and drive the screws.

8 For the buttons (C), cut two $\frac{1}{2}$ x $\frac{1}{2}$ x 8" blanks. (We used walnut.) Tilt your tablesaw blade 20° from vertical. Attach an extension to the miter gauge to back the cuts, and clamp a stopblock to the extension to position the blanks. Then bevel *both* ends of each blank to form

pyramids, as shown in **Step 1, right**. Now switch to a dado blade and cut 1/4"-wide dadoes, where dimensioned on **Drawing 1b**, and as shown in **Step 2**. Next ebonize the ends, as shown in **Step 3**. Finally cut the buttons from the blanks, as shown in **Step 4**. Let them dry for 24 hours.

Now finish and assemble

1 Inspect the frame and finish-sand any areas that need it. Then squeeze a drop of glue in the square holes and glue the buttons (C) in place.

2 Apply a clear finish to all the parts. (We wiped on three coats of Minwax Antique Oil Finish.) To avoid damage to your photo, do not finish the inside face of the back (D).

3 Drill pilot holes for fastening the turnbuttons, where shown on **Drawing 1**, and screw them in place. For a hanging frame, fasten a sawtooth hanger to the top rail.

4 Have a piece of single-strength glass cut to size. Then place the frame facedown, and lay in the glass and photo. Add the back, and secure it with the turnbuttons.

Written by **Jan Svec** with **Kevin Boyle**
Project design: **Jeff Mertz**
Illustrations: **Roxanne LeMoine; Lorna Johnson**

Materials List

Part		FINISHED SIZE			Matl.	Qty.
		T	W	L		
A	stiles	3/4"	2"	14"	F	2
B*	rails	5/8"	2"	11 1/2"	F	2
C*	buttons	1/2"	1/2"	1/2"	W	4
D	back	1/4"	8"	10"	H	1
E	leg blank	3/4"	1 1/2"	6 3/4"	F	1

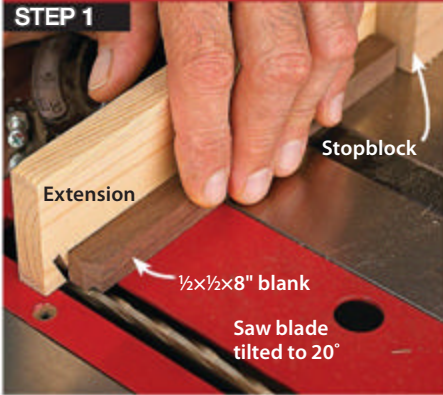
*Parts initially cut oversize. See the instructions.

Materials key: F–Douglas fir, W–walnut, H–tempered hardboard.

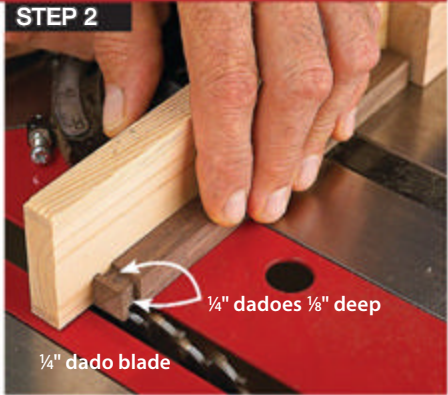
Supplies: Black permanent felt-tip marker, spray adhesive, double-faced tape, #2x3/8" brass flathead wood screws, #6x1" flathead wood screws, turnbuttons, single-strength glass, sawtooth hanger (optional).

Blade and bits: Stacked dado set, 1/4" rabbet and chamfer router bits, 1/4" brad-point bit.

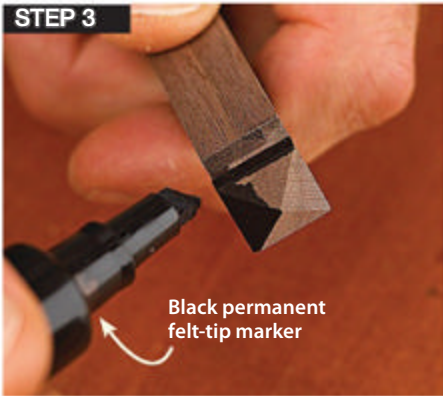
MAKE EBONIZED PYRAMID BUTTONS IN FOUR EASY STEPS



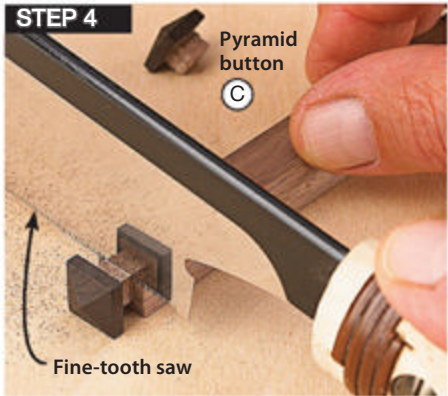
Using a stopblock to keep the facets even and rotating the button (C) blank between cuts, form shallow pyramids on both ends.



Position the stopblock to align the button (C) blank with a 1/4" dado blade. Make 1/8"-deep cuts in all four faces at both ends of the blank.



With the buttons (C) formed but still attached to the blank, ebonize them with a black permanent felt-tip marker.



Finally, with buttons (C) formed and ebonized at both ends of the blank, separate them with a fine-tooth handsaw.

SHOPTIP 38

Riftsawn vs. flatsawn

Selecting the straight, even figure of riftsawn grain for narrow parts, such as the stiles and rails of cabinet doors and picture frames, greatly enhances the overall appearance of a project. Any pile of flatsawn boards contains many that exhibit ample riftsawn grain along one or both edges. For the best appearance, select boards with closely spaced annual growth rings. The photos at *right* show an ordinary flatsawn Douglas fir 1x4.



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Classic 19th-century styling combined with an inexpensive quartz clock movement gives this masterpiece timeless good looks and modern practicality.

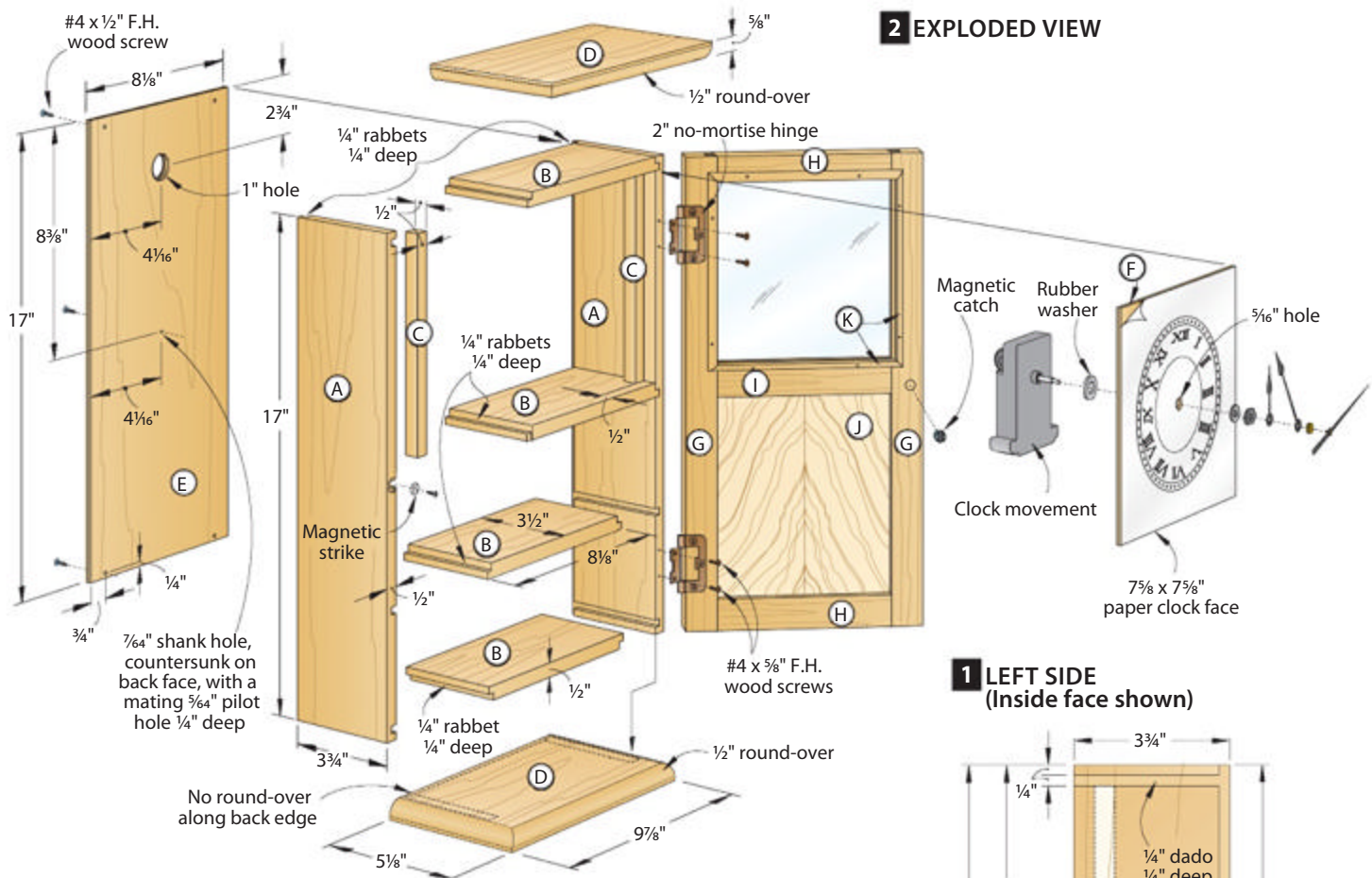


Open the magnetically latched door and voilà—you have access to two shelves for hidden storage of small items.

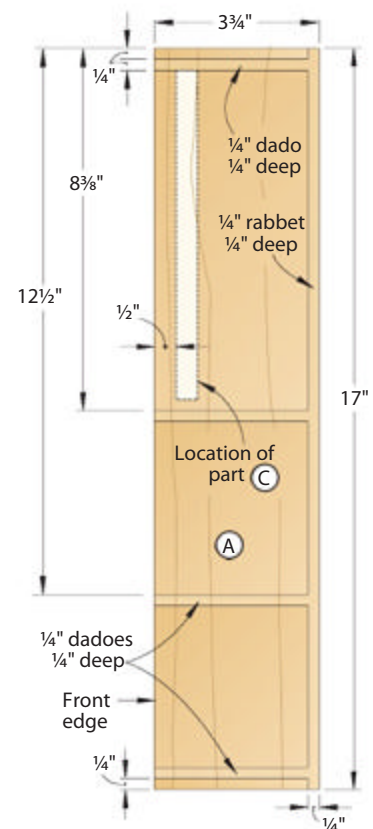


Shaker Clock

2 EXPLODED VIEW



1 LEFT SIDE (Inside face shown)



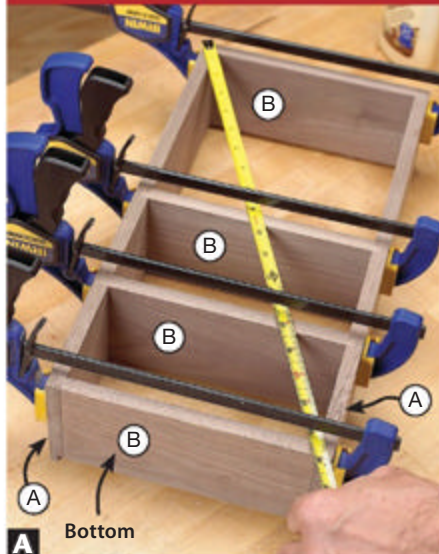
Using dado-and-rabbet joinery for the clock case and frame-and-panel construction for the door, you can build this beautiful timepiece in a week-end or a few evenings. Whether you make it from walnut with a book-matched spalted-maple panel (*left*) or cherry (*inset* photo), you'll find the clock kit, listed in **Sources** on page 60, a convenience. The kit includes a quartz clock movement and face, all of the necessary hardware, and a matching $\frac{7}{8}$ "-diameter wood knob.

Let's start with the case

1 From $\frac{3}{4}$ " stock planed to $\frac{1}{2}$ " thick, cut the sides (A) and four shelves (B) to the sizes listed in the **Materials List**.

2 On the inside face of the sides (A), lay out the locations for four $\frac{1}{4}$ " dados and a $\frac{1}{4}$ " rabbet along the back edge, where dimensioned on **Drawing 1**, noting that the parts are mirror images. Using a $\frac{1}{4}$ " dado blade in your tablesaw and an auxiliary extension on your miter gauge to prevent chip-out, cut the $\frac{1}{4}$ "-deep dados. Then, using an auxiliary fence attached to your rip fence, cut the $\frac{1}{4}$ "-deep rabbets.

ASSEMBLE THE CASE



Glue and clamp the sides (A) and shelves (B) together. Verify square by checking for equal diagonal measurements.

3 Using the same tablesaw setup, cut $\frac{1}{4}$ " rabbets $\frac{1}{4}$ " deep on the ends of the shelves (B), where shown on **Drawing 2**, to fit the dados in the sides (A).

4 Sand the sides and shelves with 220-grit sandpaper. Then assemble the

case, as shown in **Photo A**, making sure the rabbets on the top and two middle shelves face up and on the bottom shelf face down.

5 From $\frac{3}{4}$ " stock planed to $\frac{1}{2}$ " thick, cut the clock-face mounting blocks

3 DOOR (Inside face shown)

This diagram illustrates the assembly of a door with the following components and dimensions:

- Top Rail (H):** 7 1/8" wide, 3/8" rabbets 1/2" deep routed after assembly.
- Bottom Rail (H):** 1 1/8" high, 1/4" groove 3/8" deep.
- Side Rail (G):** 8 5/16" wide, 16 7/8" high, 5/16" hole 9/16" deep.
- Stiles (I):** 7 13/16" high, 1/4" groove 3/8" deep.
- Panel (J):** 7" wide, 7 13/16" high.
- Knob:** Wood knob with 5/16" hole 9/16" deep.
- Hinge:** 2" no-mortise hinge, 1/4" grooves 3/8" deep.
- Lock:** 5/64" pilot hole 5/8" deep, 1/4" groove 3/8" deep.
- Glass:** 1/8" x 7 x 7" glass, 3/8" round-over.
- Wire Brad:** #18 x 1/2" wire brad.
- Magnetic Catch:** 5/16" hole.
- Mitered ends:** 1/4" wide, 3/8" deep.

3a TENON DETAILS

1/4" groove 3/8" deep

1/4" wide, 3/8" deep

3a TENON DETAILS

Diagram illustrating the dimensions for a tenon joint. The dimensions shown are:

- 1/4" groove
- 3/8" deep
- 1/4"
- 3/8"
- 1 1/8"
- 3/4"

Diagram of the front of the cabinet showing the placement of hardware G, H, I, and J. Hardware G is on the left stile, H is on the top, I is on the bottom, and J is on the right. Dimensions are provided: 8 $\frac{1}{16}$ " for the height of the upper section, $\frac{9}{16}$ " for the width of the upper section, and $\frac{3}{8}$ " hole $\frac{7}{16}$ " deep for wood knob for the lower section. The centerline of the part and wood knob is also indicated.

can make a solid panel by planing stock to $\frac{1}{4}$ " thick and cutting it to the finished size of $7 \times 7\frac{1}{16}$ ". Edge-glue the pieces together, aligning the grain as closely as you can. After the woodworker's glue dries, plane the panel to $\frac{1}{4}$ " thick to fit the grooves in the stiles (G) and rails (H, I). Cut the panel to the finished size. Then sand the panel smooth to 220 grit.

5 To position the center rail (I) in the door, mark centerlines on masking tape on the *outside* face of the rail at the ends. Also, referring to **Drawing 3b**, mark alignment lines on the *outside* face of the stiles (G) $8\frac{1}{16}$ " from the top ends. Dry-assemble the stiles, rails (H, I), and panel (J), aligning the marks on the center rail and stiles. Verify the parts fit together correctly. Then glue and clamp the door, as shown in **Photo C**. After the glue dries, sand the door.

6 Rout a $\frac{3}{8}$ " rabbet $\frac{1}{2}$ " deep around the top opening of the door on the *inside* face for the glass and glass stops (K), where shown on **Drawing 3**. (This removes the inside lips of the $\frac{1}{4} \times \frac{3}{8}$ " grooves in the door.) To avoid chip-out, rout the opening in two passes. Square the corners with a chisel.

7 To mount a $\frac{7}{8}$ "-diameter Shaker-style wood knob on the door, where shown on **Drawing 3**, mark a centerpoint for a $\frac{3}{8}$ " hole on the *outside* face of the left stile (G), where dimensioned on **Drawing 3b**. Using a $\frac{3}{8}$ " Forstner bit, drill a $\frac{7}{16}$ "-deep hole. Sand the knob. Then glue it in place.

8 To install a magnetic catch and strike for the door, where shown on **Drawing 2**, mark a centerpoint for the catch on the *inside* of the left stile (G), where dimensioned on **Drawing 3**. Use a $\frac{5}{16}$ " brad-point bit to drill a $\frac{1}{16}$ "-deep hole in the stile. Then press in the catch. Next, mark a centerpoint for the strike on the front edge of the left case side (A), where dimensioned on **Drawing 4**. Using a $\frac{1}{2}$ " Forstner bit, drill a $\frac{1}{16}$ "-deep hole. Now drill a $\frac{1}{16}$ " pilot hole $\frac{1}{2}$ " deep centered in the hole. Set the strike plate and attaching screw aside.

9 To make the glass stops (K), where shown on **Drawing 3**, plane or resaw a piece of $\frac{3}{4} \times 4 \times 12$ " stock to $\frac{3}{8}$ " thick. Then rout and rip four stops from this blank as explained in the first of the three **Shop Tips** on page 60. You'll miter-cut the stops to length to fit the door opening later.

Time to finish up
1 Finish-sand any areas that need it, and remove the dust. Apply three coats of a clear finish to the door, back (E), and the case, except for the front face of the clock-face mounting blocks (C). (We used Deft aerosol Satin Clear Wood Finish, sanding to 320 grit between coats.)

Time to finish up

2 Have $\frac{1}{8}$ " glass cut to 7×7 ". Clean and place it in the rabbeted door opening. Then miter-cut the four glass stops (K) to length to fit the opening. Attach the stops to the door with #18 $\times \frac{1}{2}$ " wire brads where shown on **Drawing 3** and as explained in **Shop Tips 40** and **41**. Set the brads, and fill the holes with a matching wood putty.

3 Drill pilot holes, and screw a pair of 2" no-mortise hinges on the *inside* of the door, where dimensioned on **Drawing 3**.

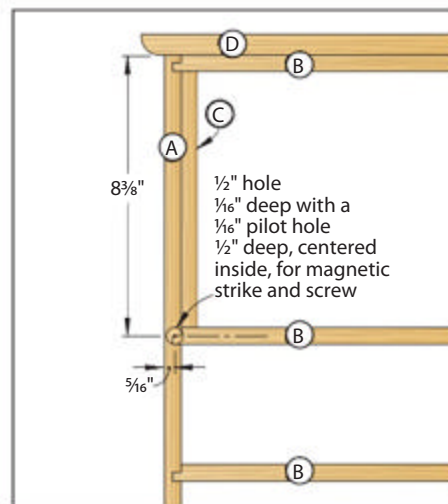
4 To attach the door to the case, place the case faceup on your workbench.

Apply two layers (for best adhesion) of double-faced tape to the case side of the small hinge leaves. Position the door on the case, flush with the sides (A) and centered between the top and bottom (D). Press firmly on the door to adhere the taped hinge leaves to the case. Then carefully open the door, drill pilot holes, and fasten the hinges, as shown in **Photo D**. Now remove the door and tape, and remount the door.

5 Mount the magnetic strike in its hole in the side (A) using the supplied screw.

6 With the clock faceup on your workbench, apply glue to the clock-face mounting blocks (C). Then position the clock face in the case. Place a two-pound object on the face, centering it to evenly distribute the weight while the glue dries.

4 MAGNETIC-CATCH STRIKE-PLATE LOCATION

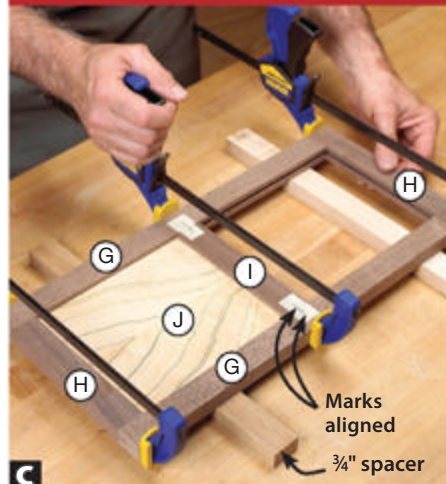


FORM THE RAIL TENONS



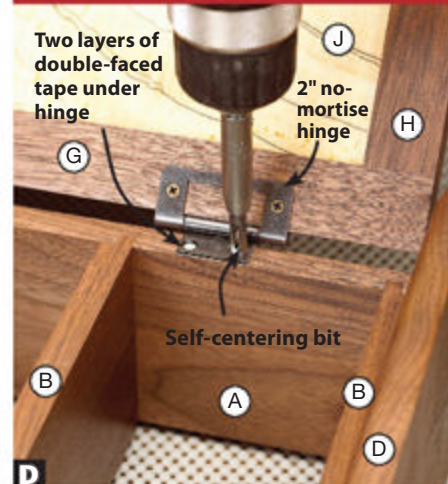
Using an auxiliary extension on your miter gauge for backup and your rip fence as a stop, form $\frac{3}{8}$ "-long tenons on the rails (H, I).

GLUE UP THE DOOR



Glue and clamp the door together, checking for square. Place scrap $\frac{3}{4}$ " spacers under the door to center the clamping pressure.

MOUNT THE DOOR

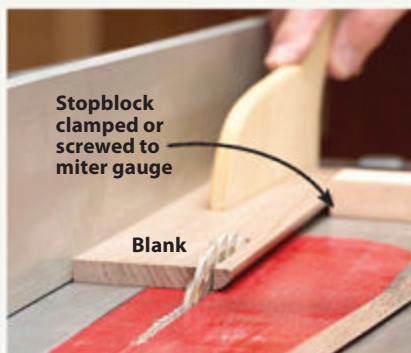


Using a self-centering bit, drill pilot holes through the small leaves of the hinges in the sides (A). Then drive the screws.

How to easily make and install small quarter-round glass stops

● **Cut narrow stock.** For safety when making narrow glass stops, such as the $\frac{3}{8}$ "-wide stops (K) for the Shaker-clock door, prepare an oversize blank planed to the thickness of the parts. Using your table-mounted router and a round-over bit ($\frac{3}{8}$ " for the clock glass stops), rout both long edges of the blank.

Position your tablesaw fence to rip a stop of the needed width ($\frac{3}{8}$ " for the clock) from the blank. To produce identical-width stops, position a stopblock against the blank, and clamp or screw the stopblock to your miter gauge. Rip a stop from the blank. Then turn the blank end for end with the cut edge against the fence. Slide the fence and blank over so that the blank touches the stopblock. Rip another stop.



● **Prevent splits.** To prevent splitting the stops when attaching them with brads, predrill angled pilot holes in the stops using a brad with its head snapped off. To chuck the brad into your drill,



use a brad that is $\frac{1}{2}$ " longer than the ones you'll drive into the stops.

● **Protect glass.** When drilling and driving the brads, place a piece of $\frac{1}{8}$ " hardboard or cardboard on the glass.

7 Position the back (E) in place with the finger hole at the top. Drill mounting holes through the back and in the case, where dimensioned on **Drawing 2**. Remove the back.

8 As directed in the instructions supplied with the clock and using the included hardware, mount the movement and hands, install an AA-size battery and set the clock.

9 Finally, screw the back (E) in place. Now when someone asks, "Does anyone know the time?" you can look at your master timepiece and answer—with confidence. 📌

Written by **Owen Duvall** with **Chuck Hedlund**
Project design: **David Denby**, Versailles, KY, with **Kevin Boyle**
Illustrations: **Roxanne LeMoine**; **Buck Jones**

Materials List

Part	FINISHED SIZE			Matl.	Qty.
	T	W	L		
A sides	$\frac{1}{2}$ "	$3\frac{3}{4}$ "	17"	W	2
B shelves	$\frac{1}{2}$ "	$3\frac{1}{2}$ "	$8\frac{1}{8}$ "	W	4
C clock-face mounting blocks	$\frac{1}{2}$ "	$\frac{1}{2}$ "	$7\frac{5}{8}$ "	W	2
D top and bottom	$\frac{5}{8}$ "	$5\frac{1}{8}$ "	$9\frac{7}{8}$ "	W	2
E back	$\frac{1}{4}$ "	$8\frac{1}{8}$ "	17"	WP	1
F clock-face backer	$\frac{1}{4}$ "	$7\frac{5}{8}$ "	$7\frac{5}{8}$ "	WP	1
G stiles	$\frac{3}{4}$ "	$1\frac{1}{8}$ "	$16\frac{7}{8}$ "	W	2
H top/bottom rails	$\frac{3}{4}$ "	$1\frac{1}{8}$ "	$7\frac{1}{8}$ "	W	2
I center rail	$\frac{3}{4}$ "	$1\frac{1}{8}$ "	$7\frac{1}{8}$ "	W	1
J* book-matched panel†	$\frac{1}{4}$ "	7"	$71\frac{1}{8}$ "	SM	1
K* glass stops	$\frac{3}{8}$ "	$\frac{3}{8}$ "	$7\frac{1}{8}$ "	W	4

*Parts initially cut oversize. See the instructions.

†As an option, you can make a solid walnut panel for J.

Materials key: W—walnut, WP—walnut plywood, SM—spalted maple.

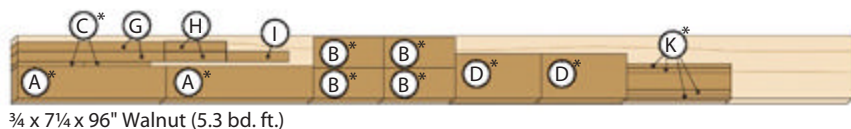
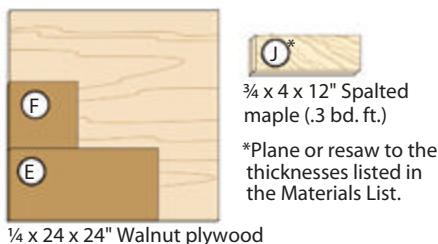
Supplies: Spray adhesive, $\frac{1}{8}$ ×7×7" glass, wood putty (color to match stock), cloth-backed double-faced tape, AA-size battery, #18× $\frac{1}{2}$ " wire brads, #4× $\frac{1}{2}$ " flathead wood screws (5), and #4× $\frac{3}{8}$ " flathead wood screws (10).

Blade and bit: Dado-blade set; $\frac{3}{8}$ " and $\frac{1}{2}$ " round-over and $\frac{3}{8}$ " rabbeting router bits; $\frac{3}{8}$ ", $\frac{1}{2}$ ", and 1" Forstner bits; $\frac{5}{16}$ " brad-point bit.

Sources

Clock kits. Kits include a magnetic catch with strike plate, matching $\frac{7}{8}$ "-diameter Shaker wood knob, 2" no-mortise hinges (1 pr.), quartz clock movement, and $7\frac{5}{8}$ × $7\frac{5}{8}$ " paper clock face. Order kit no. SK-WAL-Q (includes a walnut knob) or kit no. SK-CH-Q (includes cherry knob), \$14.95 plus freight. Schlabaugh and Sons Woodworking, 720 14th Street, Kalona, IA 52247. Call 888-636-4478; schsons.com.

Cutting Diagram



construction-grade Mobile Crane

Junior operating engineers will enjoy doing the heavy lifting with this fully operational construction toy.

Before your favorite youngster gets bogged down in video games, give a gift that lets one's imagination do the lifting—this sturdy wooden crane.

Make the chassis

1 For the chassis (A), cab (G), and counterweight (H), cut a $1\frac{1}{2} \times 6\frac{1}{4} \times 12$ " blank. (We used walnut.) Rip a $\frac{1}{2}$ "-wide piece from one edge, and set it aside for the cab and counterweight. Cut the remaining piece to size for the chassis [Materials List, page 65].

2 Lay out the chassis (A) front and rear bevels [Drawing 1], and bandsaw and sand them to shape. Then chuck an $\frac{1}{32}$ " brad-point bit into your drill press, position the fence $\frac{1}{2}$ " from the bit center, and drill axle holes in both sides of the chassis [Photo A]. Finish-sand the part.

Build the mast and boom

1 For the mast sides (B) and mast spacers (C), cut two $\frac{3}{4} \times 1\frac{1}{2} \times 26$ " blanks. (We used

maple.) Cut one mast side and one spacer from each blank. Chuck a 1" Forstner bit in your drill press and drill five holes in the mast sides [Drawing 2, Photo B].

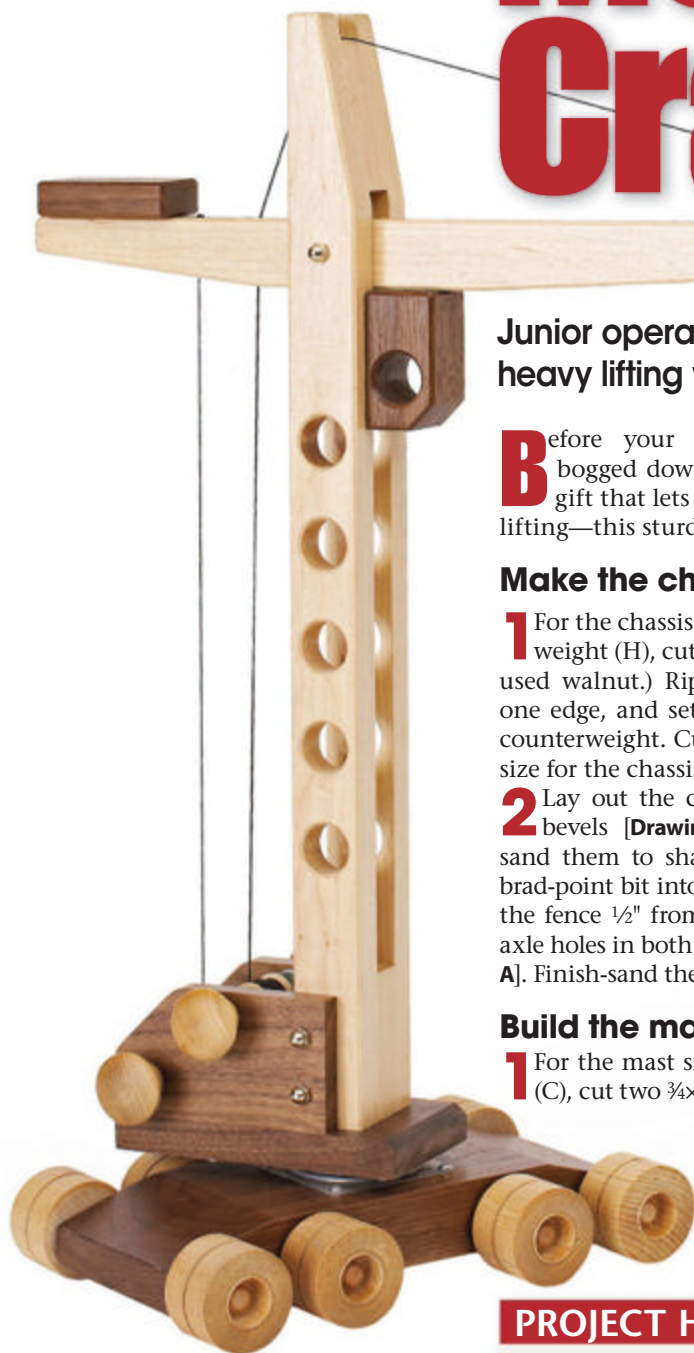
2 To assemble the mast, cut two $\frac{3}{4} \times 2\frac{1}{4} \times 24$ " cauls from scrap. (We used MDF.) Cover one side of each caul with masking tape to keep glue from sticking. Apply tape to one side of each mast (B) to mark the mast spacer (C) locations [Drawing 2]. (The thickness of the tape provides just enough of a lip to keep the spacers from shifting and makes it easy to remove excess glue.) Glue and clamp the mast [Photos C and D].

PROJECT HIGHLIGHTS

- Overall dimensions: 25" high \times 13 $\frac{3}{8}$ " reach \times 7 $\frac{3}{4}$ " track \times 11 $\frac{3}{8}$ " wheelbase.
- Hand-operated hoists raise and lower the boom and bucket.
- The tower assembly pivots smoothly on a ball-bearing lazy Susan to easily pick up and place loads.
- A wide-track chassis featuring eight sets of dual wheels provides sure-footed mobility.
- You provide the flat stock and a few wood screws. We provide a one-stop source for the remaining hardware and special fittings.

Skill Builder

- Discover how to hold rounded items steady for drilling on your drill press.



3 Mark the $\frac{3}{16}$ " boom-pivot-hole center on one mast side (B) [Drawing 2]. Insert a $\frac{3}{4}$ "-thick scrap block between the mast sides to prevent chip-out, and drill the hole.

4 Form the mast (B/C) top bevel [Drawing 2, Photo E], and sand it smooth. Sand $\frac{1}{8}$ " round-overs on the top corners of the mast sides (B) and upper mast spacer (C). Chuck a chamfer bit in your table-mounted router, and rout $\frac{1}{16}$ " chamfers along the edges of the 1" holes and the outside edges of the mast, except for the bottom. Finish-sand the mast.

5 From a $\frac{3}{4} \times 1\frac{3}{8} \times 22$ " piece of stock, resaw and plane a $\frac{1}{4}$ "-thick blank for the front spacer (D) and rear spacer (E). (We used walnut.) Cut the parts to length. Bandsaw and sand the chamfer on the front spacer and the taper on the rear spacer [Drawing 3].

6 From a $\frac{3}{4} \times 1\frac{3}{8} \times 22\frac{1}{2}$ " piece of stock, resaw and plane the two boom sides (F). (We used maple.) Glue and clamp the boom spacers (D, E) between the boom sides [Drawing 4 and Photo F].

7 With your drill press, drill a $\frac{3}{32}$ " hole through the rear spacer (E) for the boom-operating string, a $\frac{3}{16}$ " hole for the boom pivot, and another $\frac{3}{16}$ " hole at the front end of the boom [Drawing 4]. When drilling the front hole, insert a $\frac{1}{4}$ "-thick piece of scrap between the boom sides (F) to prevent chip-out. Mark the two tapered cuts, and bandsaw and sand them. Sand $\frac{1}{8}$ " radii on the boom ends. Now rout $\frac{1}{16}$ " chamfers along the edges. Finish-sand the boom.

Add cab and counterweight

1 Retrieve the walnut cab (G) and counterweight (H) blank. Mark the hole center near one end [Drawing 1a]. Chuck a 1" Forstner bit into your drill press, and drill the hole. Then bandsaw and sand the $\frac{3}{8}$ " angled corner. Crosscut the cab from the blank. Now rout $\frac{1}{16}$ " chamfers along the edges of the hole and $\frac{1}{8}$ " chamfers along the outside edges of the cab. Finish-sand the cab.

2 To position the cab (G) on the mast (B/C), first insert the boom between the mast sides (B), and slide a piece of #10-32 threaded rod through the holes in both assemblies. Then glue and clamp the cab to the mast sides (B) [Drawing 1 and Photo G]. Remove the boom from the mast.

3 From the remaining walnut blank, cut the counterweight (H) to size.

Rout chamfers on the edges [Drawing 1], and finish-sand it. Now glue and clamp the counterweight to the boom (D/E/F), $\frac{1}{2}$ " from the end and centered.

Fabricate the hoist

1 From $\frac{1}{2}$ "-thick stock, cut the hoist sides (I) to size. Adhere them face-to-face with double-faced tape. Mark hole centers [Drawing 5a], and drill the holes on your drill press with a $\frac{1}{4}$ " brad-point bit. Lay out the angled corner. Bandsaw and sand it to shape. Sand round-overs on the corners at both ends of the angle. Separate and finish-sand the parts.

2 Cut the hoist base (J) to size, making sure the width equals the combined width of the mast (B/C) and the hoist sides (I). Rout a chamfer along the top front edge [Drawing 5]. Drill shank holes for fastening the hoist base to the mast sides (B). (For the #8 screws, drill $\frac{5}{32}$ " shank holes and $\frac{7}{64}$ " pilot holes.)

3 Clamp the hoist sides (I) to the hoist base (J) [Drawing 5]. Drill $\frac{3}{4}$ " shank

DRILL THE AXLE HOLES



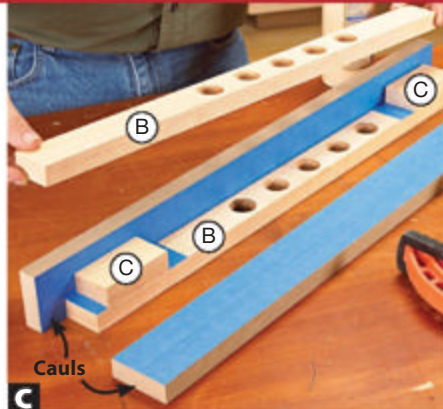
Lay out the axle-hole centers on the chassis (A). Clamp the chassis to the drill-press fence at each location, and drill $1\frac{1}{2}$ "-deep holes.

holes and $\frac{3}{32}$ " pilot holes for the #6 screws, and drive the screws. Clamp the mast (B/C) between the hoist sides. Using the screw holes in the hoist base as guides, drill pilot holes in the mast sides (B), and drive the screws. Drill $\frac{3}{16}$ " holes through the mast [Photo H].

MACHINE AND ASSEMBLE THE MAST



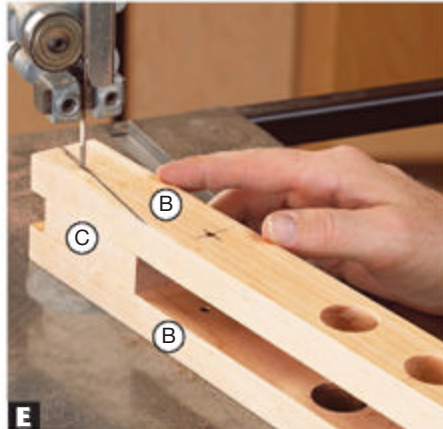
Join the two mast sides (B) with double-faced tape, mark the 1" hole centers, and drill through both parts.



Apply glue and position the mast spacers (C) on one mast side (B). Apply glue and add the second mast side.



Clamp the parts between the cauls, and then clamp vertically. Keep the mast sides (B) and lower mast spacer (C) flush at the bottom.

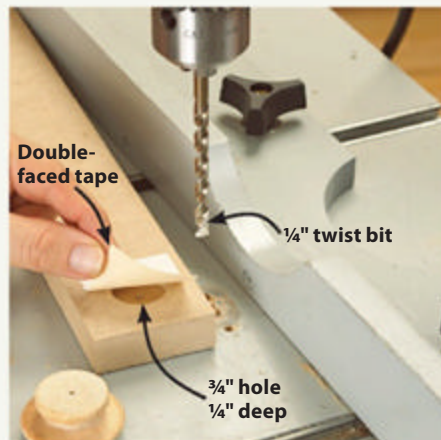


With the glue dry, remove the clamps and cauls, mark the bevel at the top of the mast, and bandsaw it to shape.

SHOPTIP 42

How to safely hold rounded objects for drilling

Enlarging the screw holes in the wood knobs for the hoist assembly presents two challenges: holding a part with a domed surface steady on the drill-press table, and keeping it from spinning as the drill bit bites into the surface. Here's an easy way to overcome both. Drill a $\frac{3}{4}$ " hole $\frac{1}{4}$ " deep in a piece of $\frac{3}{4}$ "-thick scrap. Place a $1\frac{1}{2}\times 1\frac{1}{2}$ " piece of double-faced tape over the hole, as shown at *near right*. Center the knob over the hole, and press down firmly. Now support the scrap with the drill-press fence, centering the bit on the knob screw hole, and drill, as shown at *far right*. This method also works for drilling into wood balls.



4 With the mast/hoist assembly upside down, position the lazy Susan on the hoist base (J) equidistant from the front and side edges. Drill pilot holes, and drive the screws [Drawing 1]. Then position the mast/hoist assembly on the chassis (A), and mark the lazy Susan screw-hole locations [Photo 1]. Now remove the mast/hoist assembly, and drill the holes.

5 Cut two 4"-long pieces of $\frac{1}{4}$ " dowel, and glue a spool onto each piece, centered on the length [Drawing 5]. With the glue dry, drill a $\frac{3}{32}$ " hole, centered, through each spool and dowel.

6 Enlarge the screw holes in four $1\frac{1}{4}$ "-diameter wood knobs to $\frac{1}{4}$ ",

drilling them $\frac{3}{8}$ " deep. To hold the knobs on the drill press, see **Shop Tip 42** above.

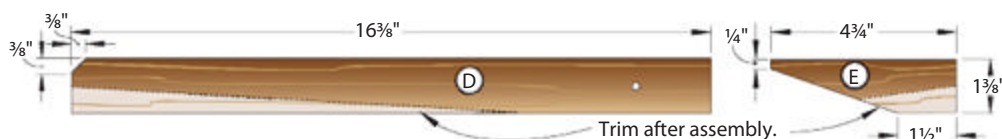
Apply finish and assemble

1 Remove the lazy Susan, mast (B/C), and hoist sides (I) from the hoist base (J). Examine all parts and assemblies, and finish-sand where needed. Slide the wheels and bucket onto a $\frac{1}{4}$ " dowel, and support it at the ends with 2x4 scraps. To hold the axles and keep finish off the ends for gluing, drill eight $\frac{3}{8}$ " holes into a 2x4 scrap and insert the axles. Drill six $\frac{1}{4}$ " holes at least 2" apart in another scrap block. Insert short pieces of $\frac{1}{4}$ " dowel into four of the holes, and press a knob on the end of each one. Wrap masking

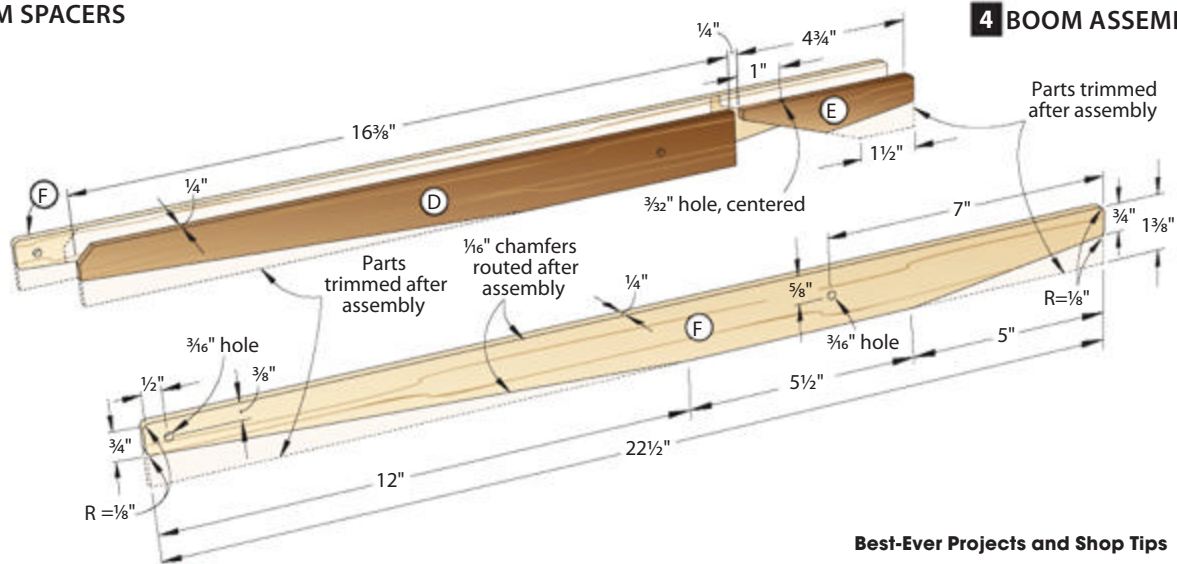
MARK CHASSIS SCREW HOLES



1 Center the lazy Susan on the chassis (A), rotate the mast/hoist assembly to uncover the mounting holes, and mark the locations.



3 BOOM SPACERS



4 BOOM ASSEMBLY

2 Slide a wheel and washer onto each axle. Glue the axles in the chassis (A) holes, inserting business cards between the wheels and washers to ensure free-spinning wheels.

3 Screw one hoist side (I) to the hoist base (J) [**Drawing 5**]. Slip a washer, spring, and another washer onto each spool dowel, and insert the dowels into the hoist-side holes. Slip another washer, spring, and washer over each dowel, and fasten the second hoist side in place, capturing the spool dowels within the hoist-side holes. Add a washer to each dowel protruding from the hoist sides, and glue the knobs on the dowels.

4 Screw the mast (B/C) to the hoist base. Cut two 3½"-long pieces of #10-32 threaded rod (⅜" longer than the total thickness of the assembly), and slide them through the hoist sides (I) and mast [**Drawing 5**]. Apply medium-strength thread locker to the rod ends, and thread on cap nuts. Screw the lazy Susan to the hoist base (J), and then to the chassis (A).

5 Cut one 2½"-long and one 1½"-long piece of threaded rod. Slide the boom (D/E/F/H) between the mast sides (B). Slide the long rod through the pivot holes [**Drawing 1**]. Apply thread locker and cap nuts. Slide the short rod through the holes at the front end of the boom, and apply thread locker and cap nuts.

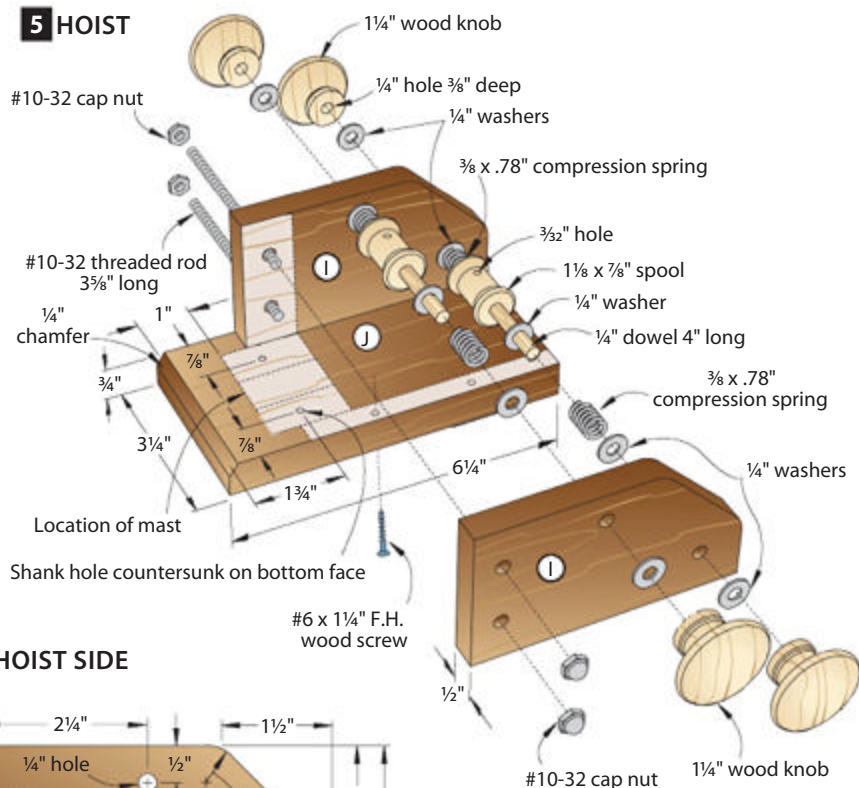
6 Cut a 24"-long piece of string and tie a knot in one end. Thread it from the top through the hole in the rear spacer (E), through the hole in

A diagram of a wood joint. A horizontal grain direction is labeled 'G' and 'H' at the top. A vertical grain direction is labeled 'A' in the center.

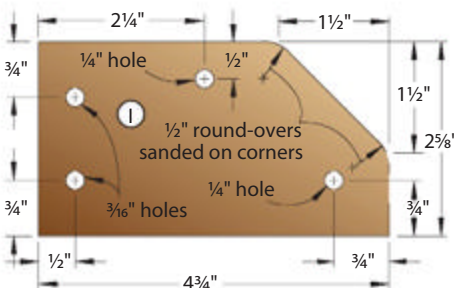
*Plane or resaw to the thicknesses listed in the Materials List.




5 HOIST



5a HOIST SIDE



the rear spool, and then tie it off. Wind the excess cord onto the spool by turning the knobs.

7 Cut a 72"-long piece of string, thread it through the hole in the front spool, and tie it off. Then route the cord through the space between the front spacer (D) and rear spacer (E), over the top of the upper mast spacer (C), and between the front spacer and the front threaded rod. Tie the snap hook onto the end of the string, and wind the excess onto the spool. Clip the bucket bail onto the hook, slip on your hard hat, and start up your engines and your imagination. 

Illustrations: **Roxanne LeMoine; Lorna Johnson**

Materials List

Part	FINISHED SIZE			Matl.	Qty.
	T	W	L		
A* chassis	1½"	4½"	11"	W	1
B* mast sides	¾"	1½"	22"	M	2
C* mast spacers	¾"	1½"	3"	M	2
D* front spacer	¼"	1⅝"	16⅜"	W	1
E* rear spacer	¼"	1⅝"	4¾"	W	1
F boom sides	¼"	1⅝"	22½"	M	2
G* cab	1½"	1½"	2¾"	W	1
H* counterweight	¾"	1½"	3"	W	1
I hoist sides	½"	2⅝"	4¾"	W	2
J hoist base	¾"	3¼"	6¼"	W	1

*Parts initially cut oversize. See the instructions.


Materials key: W–walnut, M–maple.

Supplies: #8x2" and #6x1¼" flathead wood screws, #6x½" panhead screws, double-faced tape.

Bits: 45° chamfer router bit; 3/16", 1/4", and 1 1/32" brad-point drill bits; 1" Forstner bit.

Source

Find more toy plans in this series at
woodmagazine.com/cgtoys



Sofa Table 48" wide ×
13" deep × 31¹³/₁₆" high

Coffee Table 48" wide ×
22" deep × 15¹/₁₆" high

easy and elegant

Three-Table Set

One design done three ways makes this trio of tables a perfect match.

Make any or all of these tables to create a set that suits your needs. You'll find the going easy because for most of the parts in these projects, only the length changes from table to table, but the step-by-step process remains the same.

Whatever grouping you plan to build, save time by milling all similar parts while you have a machine set up. For example, although the legs on the sofa table are longer than those on the coffee table, prepare the blanks for each set of legs, and then cut all the tapers while you've got the tablesaw set up. Likewise, you can bevel the top edging pieces for several tables at the tablesaw, then move those pieces to the router table to rout the edge profiles. This saves time and creates identical pieces for every table.

WHAT YOU'LL NEED



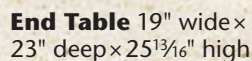
■ **Materials:** ¾" poplar boards, ½" birch plywood.
■ We also used a pocket-hole jig. (About \$40, see **Sources**, page 70.)

Note: If you make your tables from pine or oak, you'll find ready-made cove molding for parts K and L at a home center.

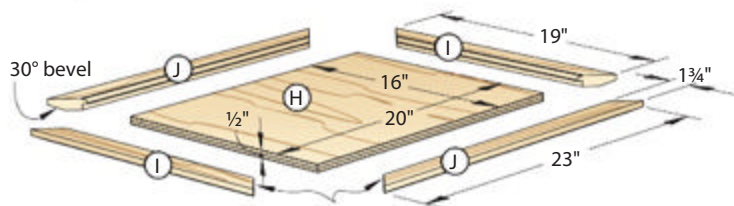
Get a leg up

1 Cut four legs (A) to the size listed in the **Materials List** on page 70, 71, or 72 for the table(s) you're building. If you can't find solid stock 1½" thick, glue up two layers of ¾" stock. Choose pieces with color and grain that blend together well at the joint line.

2 Now lay out the tapers on each leg [Drawing 1a, 3a, or 4a]. Label the best two adjacent faces of each leg as the *outside* faces. Lay out a ¾" square centered on the bottom end of each leg [Drawing 1b]. Next, mark lines on the *outside* faces (the ones you marked earlier) of each leg 1½" from the top to indicate the tops of the long tapers. Mark the tops of the short tapers on the two *inside* faces. Note that the short tapers are the same length on the end table and sofa table [Drawings



The diagram shows a square plate with a central circular hole labeled 'A'. The dimensions are given for both the inside and outside faces. The inside faces (inner square and outer circle) have dimensions of 3/8" and 3/4". The outside faces (outer square and inner circle) have dimensions of 3/4" and 3/8".



3 Cut the tapered legs with a bandsaw or use a jig to cut the tapers with a tablesaw. (You can find our free jig plan at woodmagazine.com/taperjig1, along with instructions for using it to cut leg tapers.) Align the marks for the top and bottom of the short taper along the edge of the jig. Screw down the guide, secure the leg, and cut the first taper **[Photo A]**.

4 Rotate the leg a quarter turn to cut the other short taper [**Photo A**].

Second short taper being cut

Hold-down

Guide

Top of short taper

First short taper already cut

Inside faces

Zero-clearance insert

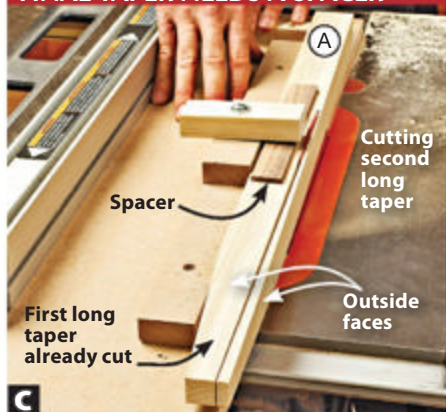
Taper jig

A

Diagram B shows the process of drilling the end cleat. A hand holds the wooden beam steady while a drill is used to create a hole. A guide block is positioned against the beam to ensure accuracy. Labels include 'End cleat', 'Guide', 'Long-taper marks', and a circled 'A'.

As with the short tapers, align the layout marks for the long tapers along the edge of the jig and reposition the guide assembly.

FINAL TAPER NEEDS A SPACER



To secure the leg when cutting the second long taper, use a spacer to fill the gap between the hold-down and the tapered leg.

While the jig is set up, cut the short tapers on the remaining legs.

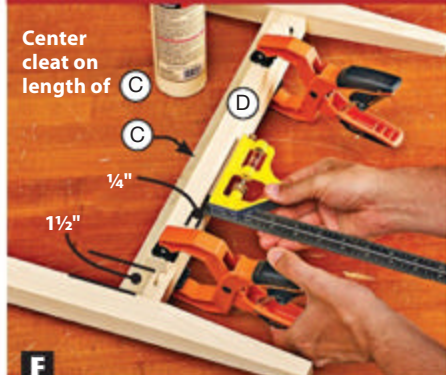
Note: The coffee table has shorter tapers than the other two tables. If you're building a combination of tables, adjust the guide on the taper jig as needed.

5 Unscrew the guide from the jig and reposition a leg on it to cut a long taper. As before, place the guide against the leg, and screw it in place [Photo B]. Cut the first long taper; then place a scrapwood spacer under the hold-down when cutting the final taper [Photo C]. Repeat this process to cut the long tapers on the remaining legs. Use a sanding block to sand the legs up to 220 grit.

Time to establish a base

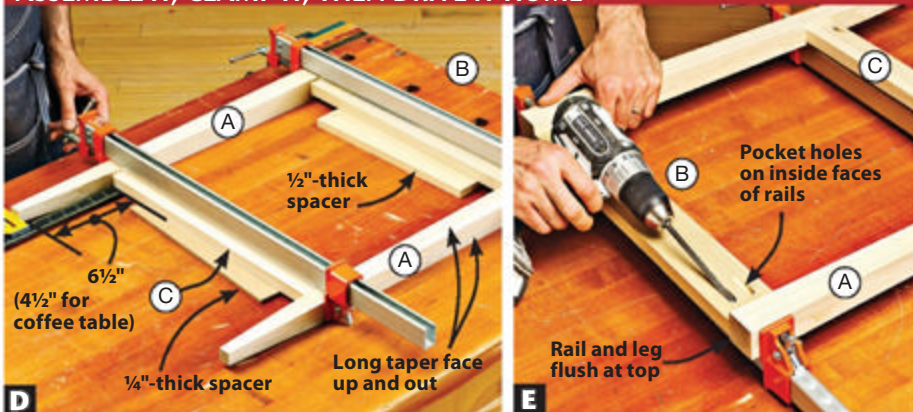
1 Cut the upper end rails (B), lower end rails (C), shelf support cleats (D), and upper front and back rails (E) to size. Drill one pocket hole in each end of the lower end rails and two pocket holes in each end of the upper rails [Drawings 2 and 2a]. Learn about pocket-hole joinery in **Shop Tip 44**, next page.

CLAMPING CLEATS



Position the shelf support cleats (D) $\frac{1}{4}$ " from the bottom of the lower end rails (C) and centered on the length of the rails.

ASSEMBLE IT, CLAMP IT, THEN DRIVE IT HOME



Clamp the upper and lower end rails (B, C) lightly between two legs (A) while positioning the rails. Spacers under the rails establish the inset. Tighten the clamps, and then flip the assembly over and drive $\frac{1}{2}$ " pocket screws through each rail into the legs.

2 Retrieve two legs (A), an upper end rail (B), and a lower end rail (C). Place the legs on a flat surface with the long tapers facing up and to the outside. Clamp the upper end rail flush with the top ends of the legs and the lower end rail $6\frac{1}{2}$ " from the bottom of the legs [Drawings 1a, 4a; Photo D]. On the coffee table, this measurement is $4\frac{1}{2}$ " [Drawing 3a]. Flip the end assembly (A/B/C) over and drive the pocket screws [Photo E]. Repeat this assembly operation for the other end.

3 Glue and clamp the shelf-support cleats (D) to the inside faces of the lower end rails (C) [Photo F].

4 Stand the side assemblies (A/B/C) on their tops and position the upper front/back rails (E) between them. Use light clamp pressure to hold the assembly together [Photo G]. After positioning the upper rails, tighten the clamps to hold everything in place and drive $1\frac{1}{2}$ " pocket screws.

5 To determine the length of the shelf (F), measure the distance between

the lower end rails (C). To find the shelf's width, add $\frac{1}{2}$ " to the length of the cleat (D). Cut the shelf to these dimensions.

6 Cut two pieces of shelf edging (G) $\frac{3}{4}$ " thick, $1\frac{3}{8}$ " wide, and the same length as the shelf (F). Glue and clamp the edging to the shelf with the top edges and ends flush. After the glue has cured, sand the assembly to 220 grit.

7 Center the shelf assembly (F/G) between the legs and clamp it in place [Photo H]. Drill $\frac{5}{32}$ " shank holes through the shelf-support cleats (D) and $\frac{3}{4}$ " pilot holes $\frac{1}{4}$ " deep in the shelf. Then apply glue to the cleats and screw the shelf to them.

Top it off

1 Cut the top (H) to match the outside dimensions of the table. Then set it aside for now. From $\frac{3}{4}\times 1\frac{3}{4}$ " stock, cut the front/back edging (I) and end edging (J) about 1" longer than dimensioned in the **Materials List**. Make an extra piece to help set up the tablesaw and router table in the next couple of steps.

IT STARTS TO LOOK LIKE A TABLE

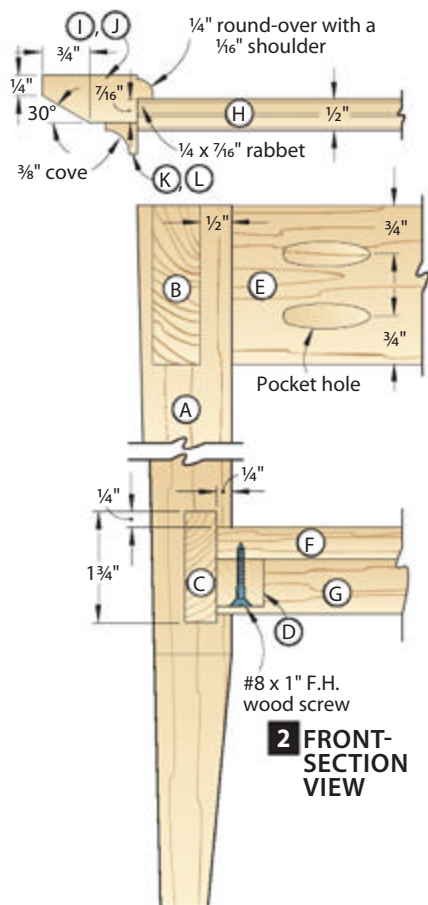


Position the upper front/back rails (E) flush with the top edge of the side assembly and $\frac{1}{2}$ " from the inside corner of the leg (A).

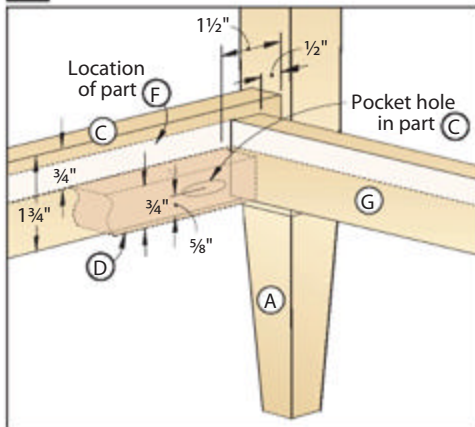
TIME TO SHELV IT



Clamp the shelf assembly (F/G) to the cleats (D) while drilling the shank and pilot holes and driving the screws.



2a LOWER-RAIL DETAIL



3 Tilt your tablesaw blade back to vertical, and complete the edging by cutting a rabbet to accept the top (H) [Shop Tip 45 at right].

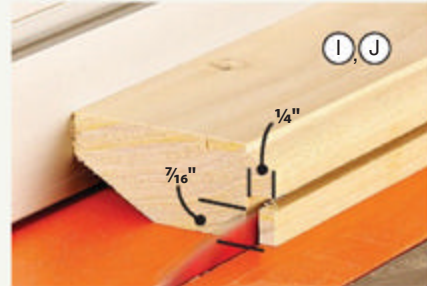
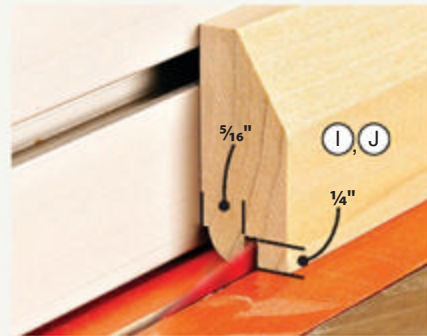
4 Miter-cut the edging (I, J) to fit around the top (H). Glue up the four pieces of edging to form a frame [Photo I]. While the frame dries, finish-sand the top to 220 grit. Sand the edging assembly (I/J) to 220 grit. Then use a sanding block on the bevel and the top and bottom faces to maintain the crisp edges of the profiles.

5 To glue the top (H) to the frame, apply a small bead of glue along the inside corner of the rabbet. Then clamp the frame and panel together. Allow the glue to cure. Now glue the top assembly (H/I/J) to the base. The edges of the

SHOPTIP 45

Two cuts for clean rabbets

To cut rabbets on the tablesaw, make two intersecting cuts. For the edging pieces (I, J), set the blade $\frac{1}{4}$ " above the table and position the rip fence $\frac{5}{16}$ " from the blade. Cut a groove the length of each edging piece, keeping the piece tight to the rip fence, *top photo*. Then raise the blade height to $\frac{7}{16}$ " and reset the fence to make a perpendicular, intersecting cut to remove the waste, *bottom photo*. The waste falls safely to the outside of the blade.



SHOPTIP 44

Quick, strong joints come right out of the pocket

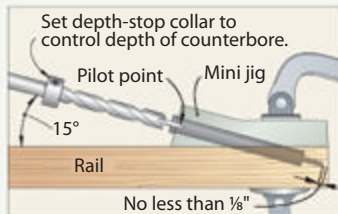
Fast, easy, and strong: That describes pocket-hole joinery. Using this method, you don't have to wait for glue to dry, so you can keep working on parts as soon as they're joined.

Making a pocket hole requires a special jig and drill bit to form a pilot hole with a deep, flat-bottomed counterbore, *top drawing*. For pieces that fit together flush, a clamp holds the pieces while you drive a pocket-hole screw into the pilot hole, *bottom drawing*. To inset one piece from another, use a spacer as shown in **Photo D**, *opposite page*.

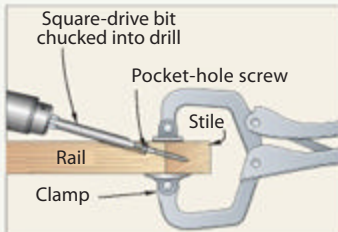
The broad, flat underside of the screwhead, shown *far right*, presses against the bottom of the hole, pulling the two pieces together. Choose fine-thread screws for use in hardwoods, and coarse-thread screws when joining softwoods.

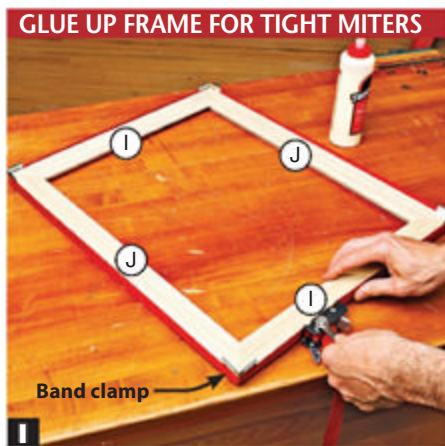
Apply glue to the mating surfaces if you want. But when one of those surfaces is end grain, as when joining the rails of the tables to the legs, the glue adds little additional strength.

DRILLING THE POCKET HOLE



DRIVING THE POCKET SCREW





I Apply glue to each mitered end, then assemble the edging into a frame. A band clamp is ideal for drawing the corners closed.

plywood panel should be flush with the outside faces of the legs.

6 Measure between the outside edges of the legs at the front and side of the table. Prepare two $\frac{1}{2} \times 4$ " blanks 1" longer than each of the measurements. Rout a $\frac{3}{8}$ " cove along each long edge of each blank. Take the blanks to the table-



J Miter-cut the cove molding (K, L) to length, testing the fit of all four pieces around the table before gluing it in place.

saw and rip away $\frac{1}{2}$ "-wide pieces for the front/back cove (K) and end cove (L).

7 Miter-cut the front cove (K) to length so the two short points match up exactly with the outside corners of the front legs. Clamp the cove in place temporarily below the edging (I, J) [Drawing 2]. Next, miter an end cove (L) to length

so it fits against the front cove and the opposite short point lines up exactly with the outside corner of a rear leg. Repeat this process for the other end cove (L); then miter the back cove (K) to fit between the two end coves. Once all the coves are cut to length, glue them in place [Photo J].

8 Finish-sand the table to 220 grit, and apply a finish. (We used Old Masters Dark Mahogany, and then brushed on two coats of Minwax satin polyurethane, buffing with a 300-grit sanding sponge between coats.)

Written by **Craig Ruegsegger** with **Kevin Boyle**
Project design: **Jeff Mertz**
Illustrations: **Roxanne LeMoine; Lorna Johnson**

Materials List (end table)

Part	FINISHED SIZE			Matl.	Qty.
	T	W	L		
A legs	1½"	1½"	25"	P	4
B upper end rails	¾"	2½"	17"	P	2
C lower end rails	¾"	1¾"	17"	P	2
D shelf-support cleats	¾"	¾"	14"	P	2
E upper front/back rails	¾"	2½"	13"	P	2
F shelf	½"	14½"	13½"	BP	1
G shelf edging	¾"	1¾"	13½"	P	2
H top	½"	20"	16"	BP	1
I* front/back edging	¾"	1¾"	19"	P	2
J* end edging	¾"	1¾"	23"	P	2
K* front/back cove	½"	½"	17"	P	2
L* end cove	½"	½"	21"	P	2

*Parts cut long initially, then mitered to fit.

Materials key: P—poplar, BP—birch plywood.

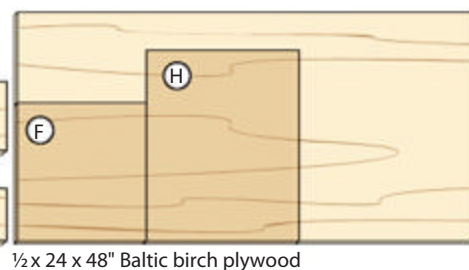
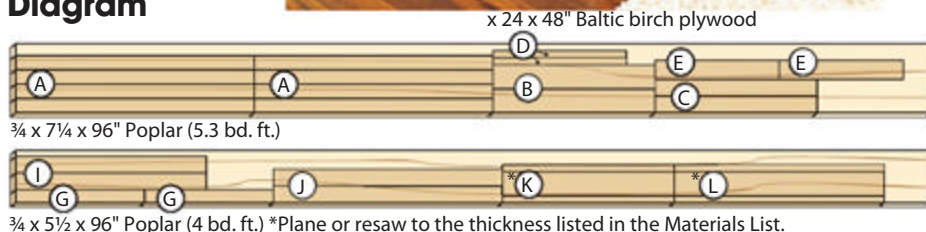
Supplies: #8x1" flathead wood screws, 1½" pocket-hole screws.

Bits: ¼" round-over, ⅜" cove router bits.

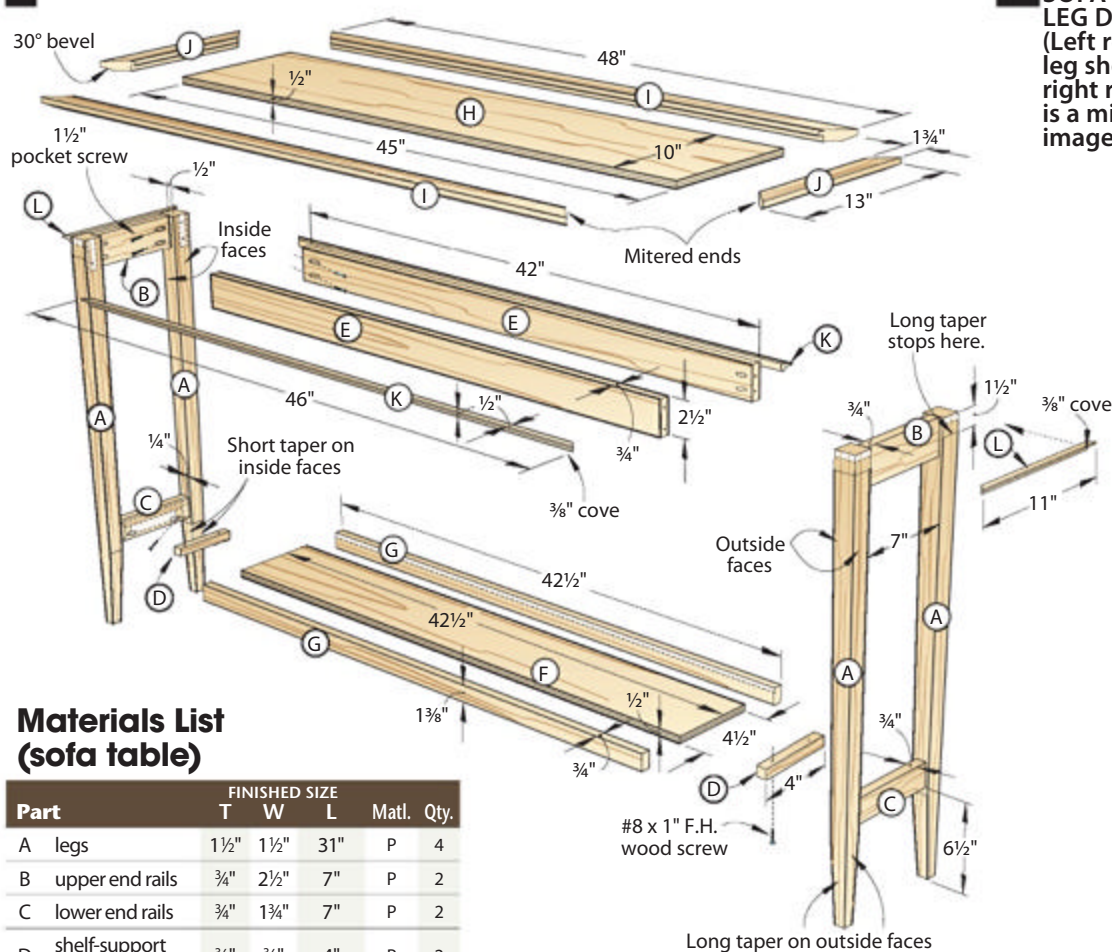
Sources

Pocket-hole jig: Kreg R3, \$39.95 (item 22708) from Rockler Woodworking and Hardware, rockler.com, 800-279-4441. R3 jig also available for \$39.99 (item 147643) from Woodcraft Supply, woodcraft.com; 800-225-1153.

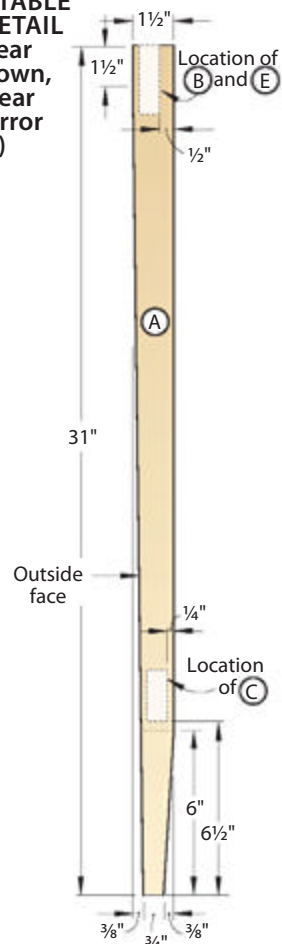
End Table Cutting Diagram



4 SOFA TABLE EXPLODED VIEW



4a SOFA TABLE LEG DETAIL (Left rear leg shown, right rear is a mirror image)



Materials List (sofa table)

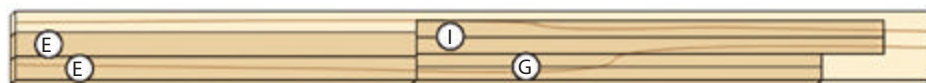
Part	FINISHED SIZE			Matl.	Qty.
	T	W	L		
A legs	1 1/2"	1 1/2"	31"	P	4
B upper end rails	3/4"	2 1/2"	7"	P	2
C lower end rails	3/4"	1 3/4"	7"	P	2
D shelf-support cleats	3/4"	3/4"	4"	P	2
E upper front/back rails	3/4"	2 1/2"	42"	P	2
F shelf	1/2"	4 1/2"	42 1/2"	BP	1
G shelf edging	3/4"	1 3/8"	42 1/2"	P	2
H top	1/2"	10"	45"	BP	1
I* front/back edging	3/4"	1 3/4"	48"	P	2
J* end edging	3/4"	1 3/4"	13"	P	2
K* front/back cove	1/2"	1/2"	46"	P	2
L* end cove	1/2"	1/2"	11"	P	2

*Parts cut long initially, then mitered to fit.

Sofa Table Cutting Diagram



3/4 x 7 1/4 x 96" Poplar (5.3 bd. ft.)



3/4 x 7 1/4 x 96" Poplar (5.3 bd. ft.)



3/4 x 5 1/2 x 60" Poplar (2.5 bd. ft.) *Plane or resaw to the thickness listed in the Materials List.



1/2 x 24 x 48" Baltic birch plywood



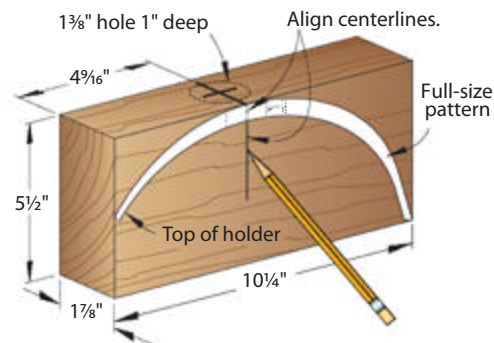
attention-grabbing Bottle Holder

More than one way to hold a wine bottle



This C-shaped wine-bottle holder appears to defy gravity, but rest assured that the photo *above* didn't involve any tricks or digital manipulation.

Begin with a block of wood dimensioned as shown in the drawing *above right*. (You may need to laminate thinner stock and cut and plane the lamination to size.) Then draw a reference line across the block where shown. With spray adhesive (3M makes a popular artist's adhesive sold at office-supply and art stores), adhere the pattern to the block. Be sure to align the hole centerline on the block with that on the pattern. Now drill the centered $1\frac{3}{8}$ " hole. Bandsaw the holder to shape, working just outside the pattern's cutline. Next, sand the holder to the line. A disc sander works best for sanding the outside or convex surface; an oscillating spindle sander for the inside or concave surface. Finish-sand the holder through 220 grit, and apply finish. (We used Minwax Antique Oil.) 🍷



**WINE-BOTTLE HOLDER
FULL-SIZE PATTERN**

Hole
centerline

$1\frac{3}{8}$ " hole,
centered

Side view

Find more plans for gifts and
decorative accessories at
woodmagazine.com/gifts

a gem of a Jewelry Chest

With elegance befitting its shimmering contents, this spacious case will become a treasured dressing-table accessory.



PROJECT HIGHLIGHTS

- Overall dimensions: 10½" wide × 8⅞" deep × 17½" tall.
- Materials needed: ¾" walnut; ¼" birch plywood.
- Hooks provide for hanging necklaces and bracelets.
- Ring bar and two velvet-lined drawers hold a variety of jewelry.

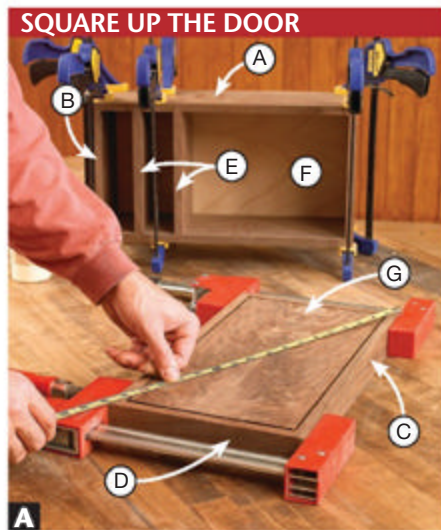
Start by building an open-and-shut case

2 Set up your table saw with a 1/2" dado blade, and cut dados and rabbets where shown in the sides (A) and door sides (C) [**Drawings 2, 3**].

4 On the left side (A) and left-door side (C), lay out matching mortises to fit the hinges [**Drawings 1, 2, 3**]. Rout the mortises, or cut them with a hand-saw and a chisel.

6 Cut the shelves (E), case back (F), and door panel (G) to size. (We book-matched some figured walnut for our panel. Learn more about book-matching in **Shop Tip 46**, *next page*.) To create an exposed shadow line on the door, rout a $\frac{3}{8}$ " rabbet $\frac{1}{4}$ " deep around the front face of the door panel [**Drawing 3**].

8 Apply glue to the rabbets on the door sides (C) and to the middle 3" only along the top and bottom of the door panel (G). Then assemble and clamp the panel, door sides, and door top and bottom (D) [**Drawing 3, Photo A**]. Finish-sand the case and door, using progressively finer grits from 120 to 320.



Check the door for square as you clamp it. Lay it faceup on a flat surface to ensure that the inside edges remain flat.

SHOPTIP 46

Book-match 'em, Danno

Create distinctive mirror-image grain patterns with book-matching. The process involves resawing a board, laying the pieces open like the pages of a book, then edge-joining the two halves to create a panel with a symmetrical pattern, *far right*.

When selecting material for a book-matched panel, look for distinctive grain that will make an interesting pattern. Also, the blank must be more than twice as thick as the glued-up panel, to allow for the saw kerf and planing of the completed panel. Joint the edge that will be the joint line; then resaw the blank down the center, *near right*. Glue the two halves together with the sawn faces up, aligning the grain patterns at the joint line, *far right*.

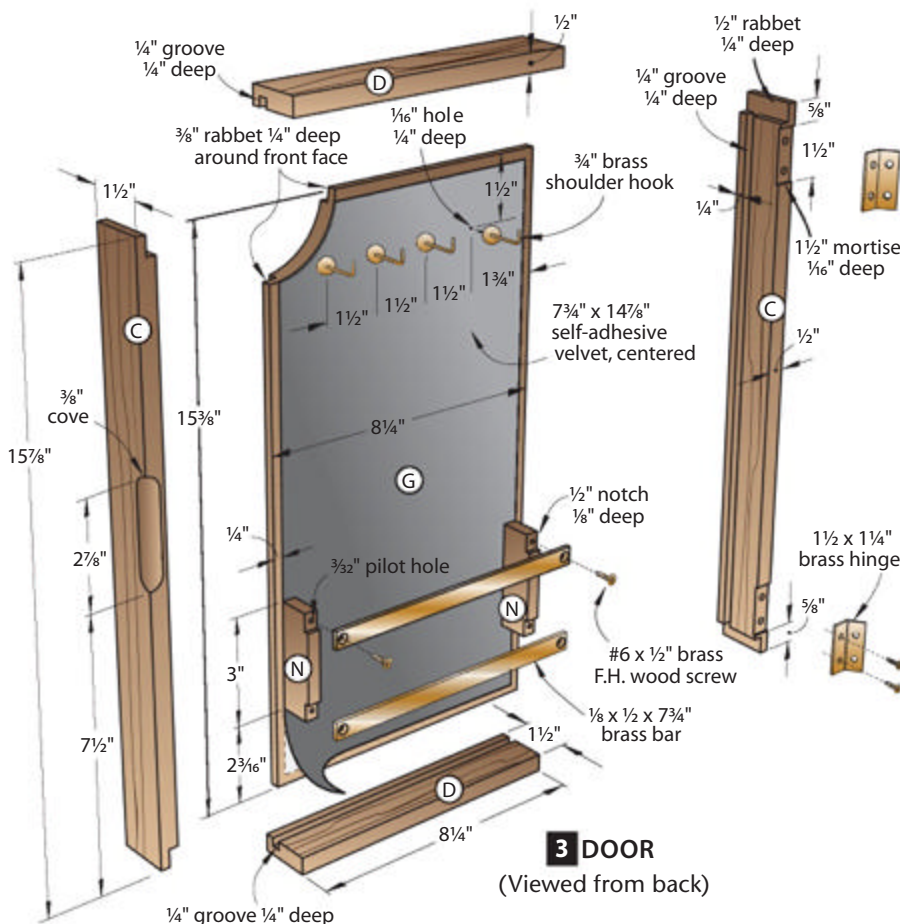
After the glue dries, plane the panel to thickness, and trim it to finished size if needed, keeping the joint line centered on the panel's width.



Mark a line down the center of one edge. Cut carefully to minimize cleanup of the sawn faces that could change the pattern match.

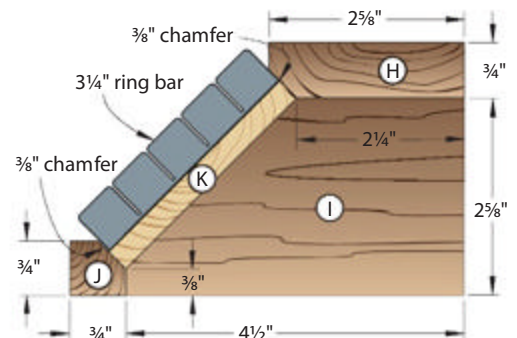


Open the resawn blank like a book. Align the grain pattern across the joint line, and glue the two halves together.



3 DOOR
(Viewed from back)

4 RING HOLDER SIDE SECTION VIEW

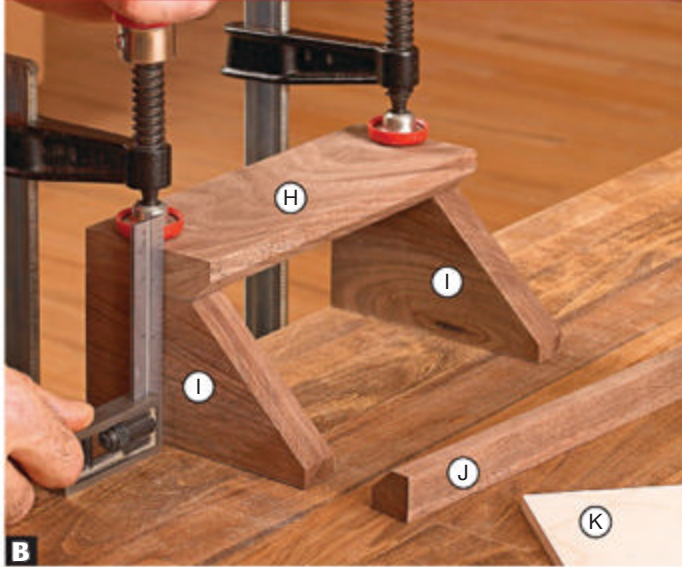


Make the ring thing next

1 Cut a $3/4 \times 3 1/2 \times 7 3/4$ " blank for the ring-holder top (H) and front (J).

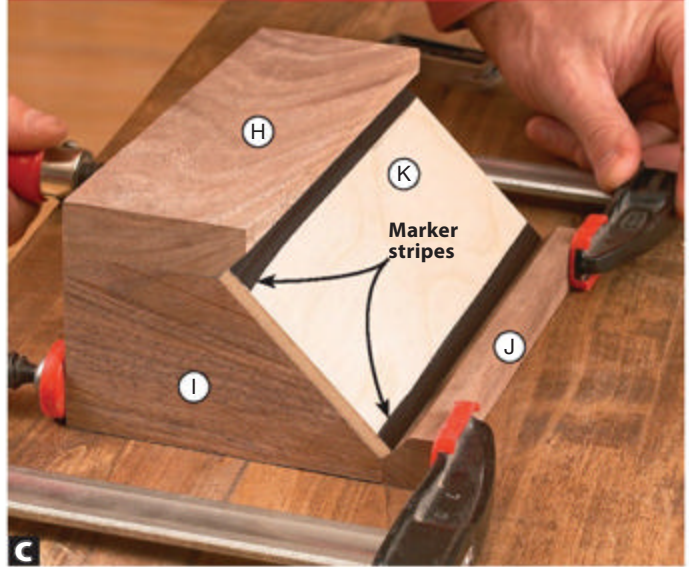
SHOPTIP 47 *Route one wide piece to make narrow parts. Starting with a blank $3 1/2$ " wide allows safer routing for parts H and J. (The $3 1/2$ " width assumes a $1/8$ " kerf. If your tablesaw blade cuts a different-width kerf, adjust the width of the blank accordingly.) To make the parts, rout $3/8$ " chamfers along both long edges of the blank, and then rip the blank to width for part H. The cut-off piece becomes part J [Drawing 4].*

CLAMP DOWN TO SQUARE IT UP



B When gluing the top (H) to the ring-holder sides (I), clamp the pieces to your bench. Check both sides for square to the benchtop.

AVOID SHOWING SUPPORT



C Draw black marker stripes about $\frac{3}{8}$ " wide on the front of the support (K) to keep the plywood from showing behind the ring bar.

2 Cut the ring-holder sides (I) to shape [Drawing 4]. Dry-fit the ring-holder sides, top (H), and front (J) together, and cut the support (K) to width to fit between the top and front.

3 Apply woodworker's glue to the top edges of the ring-holder sides (I) and clamp the top (H) in place [Photo B].

4 Glue and clamp the ring-holder front (J) to the H/I assembly, and glue the support (K) in place [Photo C]. Finish-sand the ring-holder assembly (H-K), except for the face of K.

Add the top, bottom, and feet

1 Cut the trim top and bottom (L) and feet (M) to size.

2 Using a table-mounted router, form a $\frac{3}{8}$ " cove along both ends and the front edge of the top and bottom (L) [Drawing 1].

3 Change to a $\frac{1}{4}$ " cove bit, and rout a cove on the back and inside edges of each front foot (M) and on the the front edge of each rear foot [Drawings 5, 6].

SHOPTIP 48 Check your footing. To ensure that you rout the correct edges of the feet, lay the bottom (L) facedown on your bench and position a foot at each corner. Then mark the inside and back edges of each foot.

4 Change to a 45° chamfer bit in your router, and rout a $\frac{1}{4}$ " chamfer on the front and outside edges of each front foot (M) and only the outside edge of each back foot (M) [Drawings 5, 6].

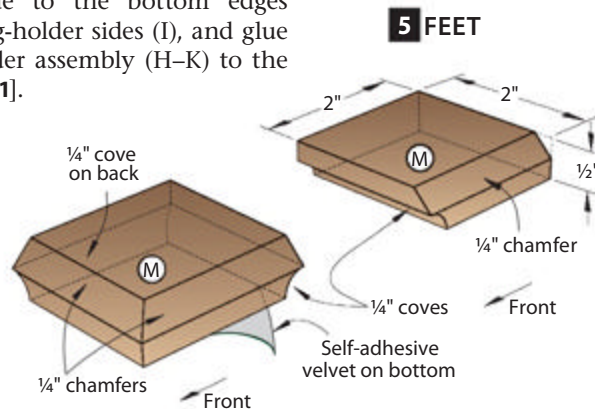
5 Glue and clamp the feet (M) to the bottom (L) [Drawing 6], positioning the straight edges of the back feet flush with the back edge of the bottom.

6 Finish-sand the top (L) and the bottom assembly (L/M). Then glue and clamp the top and the bottom assembly to the case (A/B/E/F), centered side-to-side and flush at the back [Drawing 1].

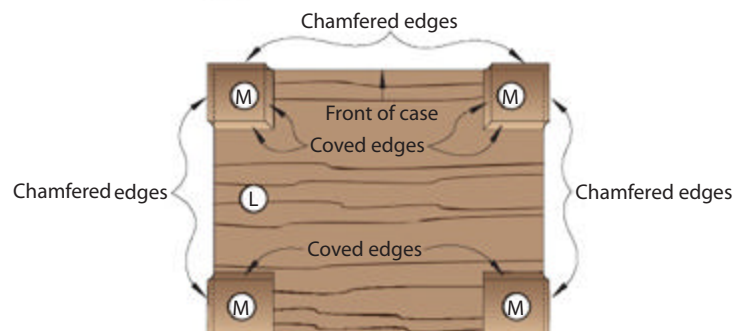
7 Apply glue to the bottom edges of the ring-holder sides (I), and glue the ring-holder assembly (H-K) to the case [Drawing 1].

Take care of door details

1 Cut the spacer blocks (N) to size, and rout or chisel the notches in them for the brass bars [Drawing 3]. Mask the backs of the spacers and the area where they glue to the door sides (C) [Photo D].



6 BOTTOM VIEW



SHOPTIP 49

Dealing with the brass

Brass, a soft alloy of copper and zinc, works easily and polishes to a golden luster, making it an ideal metal to accent woodworking projects. You can buy brass at craft and hobby shops, many hardware stores, and from online metals dealers as thin sheets, bar stock, tubing, solid rods, and other shapes.

Here are some helpful tips for making the brass bars for the jewelry case:

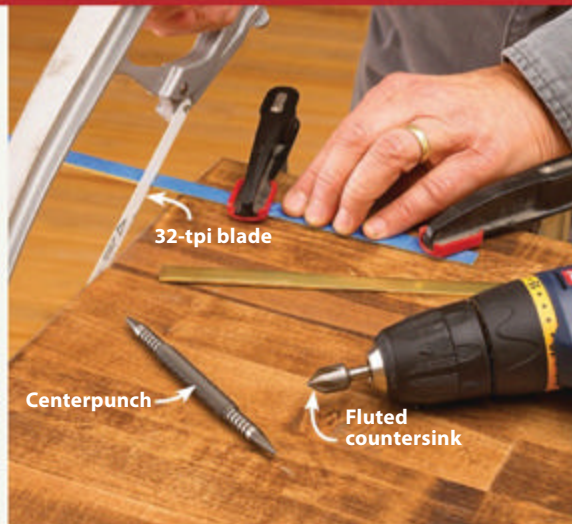
● Prevent scratches.

Flat brass often comes with a plastic protective sheet. Leave it in place for cutting and drilling. If your bar stock doesn't have protective covering, apply painter's tape. When gripping brass stock in a vise, wrap it with paper or rags for further protection.

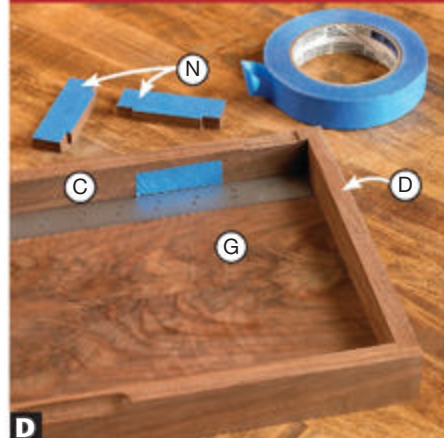
● **Cut with a hacksaw.** Brass cuts easily with a 32-tooth-per-inch hacksaw blade. Woodworking handsaws with hardened, fine teeth will cut brass, but the blades may dull quickly. After sawing, file or sand the cut end smooth.

● **Centerpunch before drilling.** Lay out hole locations accurately, and punch-mark the centers so the drill won't skid around and mar the surface. Fluted or Weldon-style countersinks work well on brass.

● **Polish and protect.** Polish the bars with progressively finer sanding sponges from 220 to 400 grit. For a shinier finish, continue polishing with 600-grit, 1,200-grit, or finer, wet-or-dry sandpaper. Spray a light coat of clear lacquer onto the bars to protect them from tarnish and fingerprints. (We used satin lacquer.)



SAVE SPOTS FOR THE SPACERS



Mask the glue surfaces for the spacer blocks (N); finishing the door and applying the velvet is easier with the spacers unattached.

ONE BLANK, TWO BLOCKS



For safer handling, mark the catch blocks on one blank. Bandsaw the blocks off the blank, cutting outside the line, and sand to the line.

2 Cut two pieces of $\frac{1}{8} \times \frac{1}{2}$ " brass bar stock to length. Lay out, drill, and countersink a $\frac{3}{64}$ " mounting hole centered $\frac{3}{16}$ " from each end [Drawing 3]. See **Shop Tip 49** above for suggestions on working with brass.

3 Position the hinges in the mortises on the door side (C), and mark and drill the screw holes. Then, do the same on the case side (A) [Drawings 1, 3]. Attach the hinges to test the door fit, and then remove them.

4 Cut a $\frac{1}{2} \times 2 \times 3$ " blank for the catch blocks (O). Lay out the two blocks on opposite corners of the blank [Drawing 7], and drill the holes for the strike plate and catch [Photo E]. Cut the catch blocks from the blank, finish-sand them, and glue them to the door and case [Drawing 1]. The catch goes on the case.

Now you need two drawers

1 Cut the drawer fronts and backs (P), sides (Q), and bottoms (R) to size [Drawing 8].

2 With a tablesaw and dado set, or a table-mounted router, form the $\frac{1}{4}$ " rabbets in the front and back (P) and sides (Q) [Drawing 8].

3 Drill a $\frac{3}{64}$ " hole centered on each drawer front (P) for the brass knobs.

4 Glue and clamp the drawers (P-R), checking for square. After the glue dries, rout a $\frac{1}{4}$ " rabbet $\frac{1}{32}$ " deep along the front bottom edge of each drawer to make a shadow line [Drawing 8]. Finish-sand the drawers.

Time for final assembly

1 Finish-sand any parts as necessary. Apply a clear finish to the case assembly, door (C/D/G), drawers (P-R), and spacer blocks (N). (We applied three coats of satin polyurethane, buffing with 320-grit sandpaper between coats.)

2 Cut and apply self-adhesive velvet to the inside of the door panel (G), the inside of the back (F) above the ring holder, and the inside of the drawer bottoms (R) [Drawings 1, 3, 8].

3 Remove the masking tape, and glue the spacer blocks (N) to the inside of the door sides (C). Drill $\frac{3}{32}$ " pilot holes in the spacer blocks, and attach the brass bars [Drawing 1]. Screw the strike plate to the catch block (O) on the door, and press the magnetic catch into the catch block on the case. Then reinstall the hinges on the door.

4 Cut a piece of cardboard to $1\frac{1}{2} \times 7\frac{3}{4}$ ". Mark the spacing for the four hooks along one edge [Drawing 3]. Position the cardboard spacing guide inside the door along the top, and drill pilot holes for the hooks [Photo F]. Repeat this for the case hooks; then screw in the hooks.

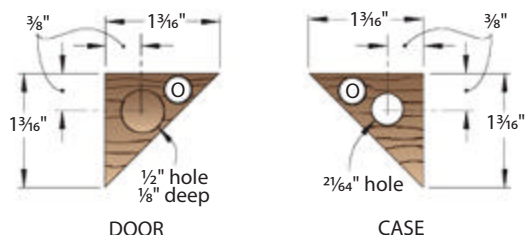
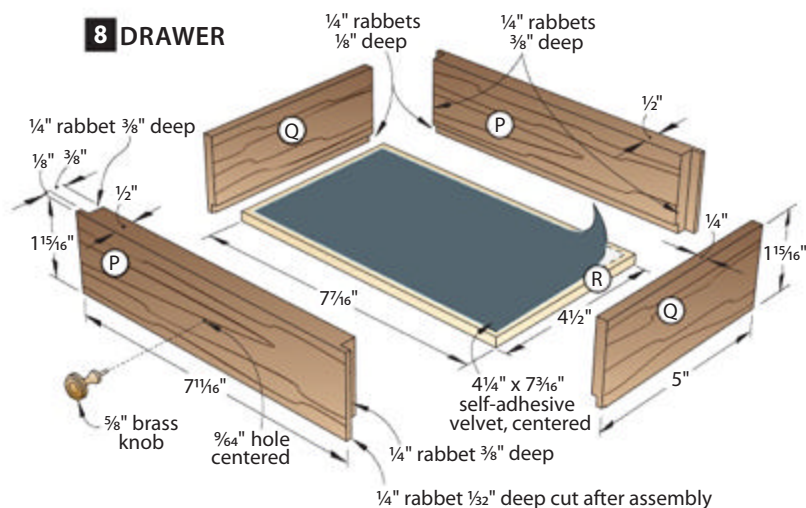
5 Cut the padded ring bar to length to fit in the case, spray adhesive on the

DRILL HANGER-HOOK HOLES



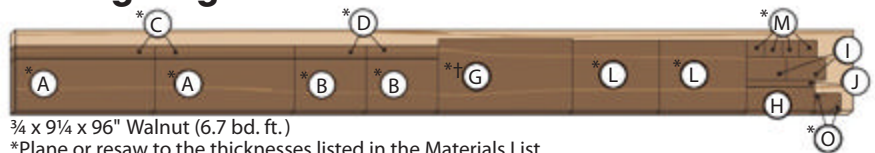
F When you drill pilot holes for the shoulder hooks, wrap a strip of painter's tape around the bit $\frac{5}{16}$ " above the tip to serve as a depth stop.

8 DRAWER



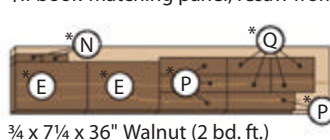
7 CATCH BLOCKS

Cutting Diagram



$\frac{3}{4}$ x $9\frac{1}{4}$ x 96" Walnut (6.7 bd. ft.)

*Plane or resaw to the thicknesses listed in the Materials List.
†If book-matching panel, resaw from $\frac{1}{4}$ "-thick material.



$\frac{3}{4}$ x $7\frac{1}{4}$ x 36" Walnut (2 bd. ft.)



$\frac{1}{4}$ x 12 x 24" Birch plywood

Materials List

Part	FINISHED SIZE			Matl.	Qty.
	T	W	L		
Case and door					
A* case sides	½"	6"	16"	W	2
B* case top/bottom	½"	6"	8¼"	W	2
C* door sides	½"	1½"	15⅞"	W	2
D* door top/bottom	½"	1½"	8¼"	W	2
E shelves	½"	5½"	8¼"	W	2
F case back	¼"	8¼"	15½"	BP	1
G door panel	½"	8¼"	15⅜"	W	1
Ring holder					
H* top	¾"	2⅝"	7¾"	W	1
I sides	¾"	2⅝"	4½"	W	2
J* front	¾"	¾"	7¾"	W	1
K** support	¼"	3¼"	7¾"	BP	1
Trim					
L top/bottom	½"	8⅛"	10"	W	2
M feet	½"	2"	2"	W	4
N spacer blocks	⅜"	⅞"	3"	W	2
O* catch blocks	½"	1⅜"	1⅜"	W	2
Drawer					
P fronts/back	½"	1⅝"	7⅞"	W	4
Q sides	¼"	1⅝"	5"	W	4
R bottoms	¼"	4½"	7⅞"	BP	2

*Parts initially cut oversize. See the instructions.

**Part width cut to fit. See the instructions.

Materials key: W—walnut, BP—birch plywood.

Supplies: #6x $\frac{1}{2}$ " brass flathead wood screws, $\frac{1}{8}$ x $\frac{1}{2}$ " brass bar stock, $1\frac{1}{2}$ x $1\frac{1}{4}$ " brass hinges (2), $\frac{3}{4}$ " brass shoulder hooks (8).

Blade and bits: dado set; $\frac{1}{4}$ " and $\frac{3}{8}$ " cove, $\frac{1}{4}$ " straight, 45° chamfer router bits.

Source

Velvet, ring bar, knobs, catch: Black self-adhesive velvet, 12x24", item 34656, \$14.99 (also available in red, item 10471; green, item 10489; and blue, item 10497); black padded ring bar, $3\frac{1}{4}$ x24", item 35248, \$29.99 (also available in red, item 32675; green, item 39840; and blue, item 32975); $\frac{5}{8}$ " brass knob, item 35451, \$5.99; $\frac{5}{16}$ " round magnetic catch, package of 4, item 29272, \$9.19. Rockler, 800-279-4441 or rockler.com.

Written by **Larry Johnston** with **Kevin Boyle**

Project design: **Jeff Mertz**

Illustrations: **Roxanne LeMoine; Lorna Johnson**

back of it, and press it onto the ring-holder support (K).

6 Attach a decorative brass knob to each drawer front (P), and slide the drawers into the cabinet. Finally, attach the door hinges to the cabinet.



wall shelf and Towel Rack

Though perfectly suited for your bath or kitchen, this project also can be used to hold quilts and collectibles throughout your house.

WHAT YOU'LL NEED



■ **Materials:** ¾" cherry, ¼" cherry (or a beadboard panel), two 1" dowels (cherry, if available).

■ **Blades and Bits:** 1" Forstner bit, ¼" rabbeting bit, ⅜" straight bit, ⅜" countersink/counterbore bit (optional).

Don't let the curving shapes and precisely positioned towel bars fool you. Using only simple tools, readily available supplies from your local home center, and the tips we provide, you'll have this project ready in a weekend.

Start by cutting the parts

1 Cut the sides (A), shelf (B), and top (C) to size [**Materials List**, page 83].

2 Enlarge the **Shelf Side Pattern** on page 84 to 125%. Mount the pattern on ¼" hardboard with spray adhesive, jigsaw to shape, and then sand the edges

smooth to create a template. Then drill a ⅛" hole through each hole center.

3 Lay the hardboard template on a side (A), with the back edges and bottom ends flush. Trace the template onto the side. Lightly hammer a 6d finish nail through each ⅛" hole to mark the dowel-hole centerpoints [**Photo A**]. Place the template, pattern down, on the other side and repeat.

4 Jigsaw the sides (A) to shape [**Photo B**]. (See **Shop Tip 51** on the next page to choose the best blade.) Then sand the profile smooth to the line.

ROUT A STOPPED RABBET



D Begin a stopped rabbet on the top (C) at the first mark and continue until you reach the mark on the opposite end.

6 With a $\frac{1}{4}$ " rabbeting bit, rout the back edge of the shelf (B) to accept the back slats (D) [Drawing 1].

7 Mark a centerline on the rabbeted edge of the shelf (B) and on the underside of the top (C). Align the two centerlines and mark the shelf ends on the top [Photo C]. Then rout a stopped rabbet on the top [Photo D] and square the corners with a chisel.

8 Cut two towel bars (E) to length and sand them to 220 grit. If you plan to stain the project, stain the towel bars before assembling the shelf.

Assemble the shelf

1 From scrap plywood, cut two $6 \times 8\frac{1}{2}$ " spacers. Clamp the spacers to the

SCREW THE SIDES TO THE SHELF



E Spacers clamped to the sides (A) keep the shelf (B) from slipping out of alignment as you drill and drive screws.

sides (A) with the edges and ends flush [Photo E]. Place the shelf (B) between the sides with the rabbet to the back facing up. Mount the towel bars (E) between the sides, and clamp the assembly.

2 Drill the counterbored shank holes for the shelf (B) screws [Drawing 1]. For the #8 screws, drill $\frac{5}{32}$ " shank holes and $\frac{7}{64}$ " pilot holes. Drill counterbores $\frac{3}{8}$ " deep. (See Shop Tips 54 and 55 on the next page for a pair of time-saving tools.) Drill and drive both back screws first, then reposition the clamp to add the front screws.

3 Center the top (C) on the sides (A), and check that the rabbet ends are flush with the inside faces of the sides. Clamp the top in position. Drill coun-

ATTACH THE TOP



F A combination counterbore/pilot drilling accessory makes quick work of boring screw holes in the top (C).

terbored shank holes in the top; then drive the screws [Photo F].

4 Cut ten 20"-long back-slat (D) blanks. If you have a router table, use a $\frac{3}{8}$ " straight router bit to rabbet the blanks [Drawing 1a]. If not, rout them freehand with a $\frac{3}{8}$ " rabbeting bit (see Shop Tip 53).

SHOPTIP 52 Swap 19 slats for one panel. If you can't find $\frac{1}{4}$ "-thick cherry stock at your local supplier, substitute beadboard plywood. Cut the plywood to fit the rabbeted opening in the back, stain it to match the cherry [Photo G], and attach it with $\frac{3}{4}$ " brads.

5 Crosscut the back slats (D) to length, then rip the rabbeted edge off the two outside slats. Sand the slats to 220

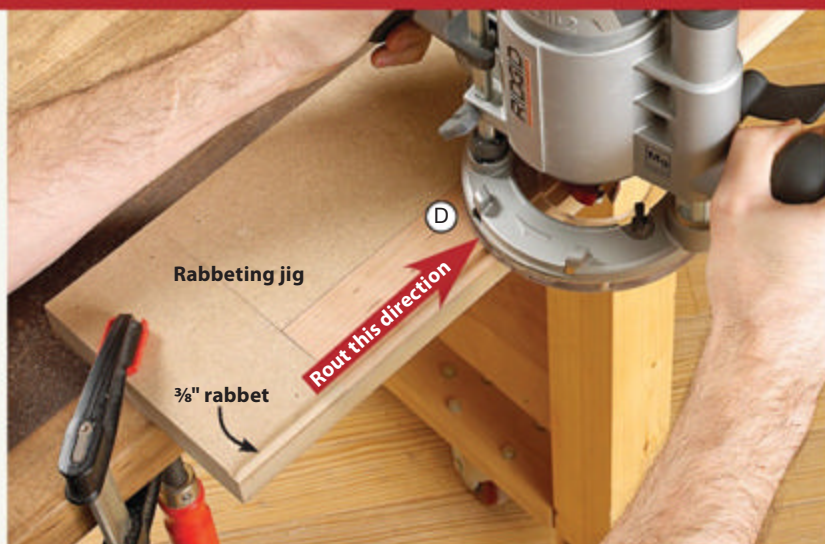
SHOPTIP 53

Rout quick, safe rabbets with this simple jig

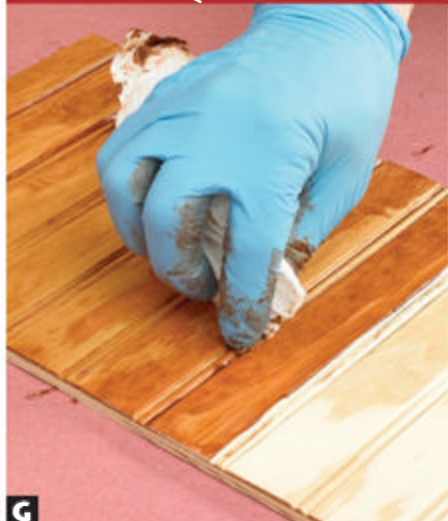
Guiding a handheld router along 2"-wide parts to cut 20 rabbets in 10 blanks can turn into a dicey balancing act. However, this simple jig makes repetitive routing a breeze.

Begin with a $\frac{3}{4} \times 6 \times 28$ " MDF base. Then add three $\frac{1}{4}$ "-thick MDF pieces—a 4×20 " piece beside the workpiece and 4×6 pieces at either end—to capture the back-slat (D) blank and support the router base.

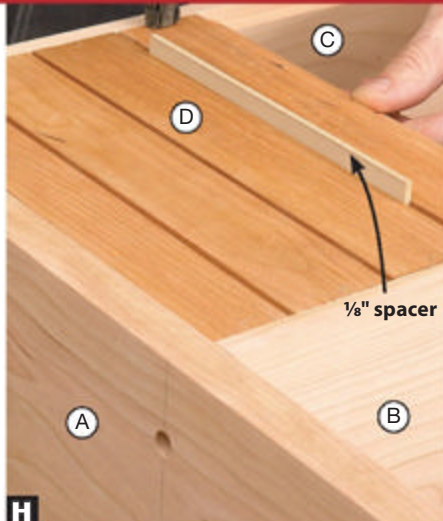
Insert a blank into the jig recess. Starting at the left end of the jig, rabbet the jig and blank edges, as shown at right. Then turn the blank upside down, and rout a second rabbet. Repeat for the other blanks.



TWO TECHNIQUES FOR ADDING A BACK TO THE SHELF

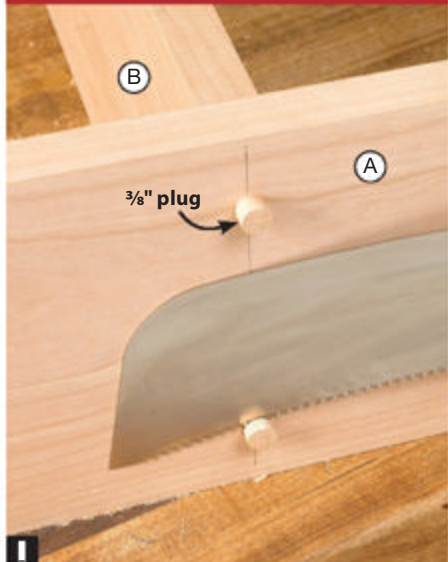


G Cherry gel stain colors pine beadboard plywood without blotching. Nail the back on after finishing the rest of the shelf.



H Nail each slat (D) to the top (C) and shelf (B) using a $\frac{1}{8}$ " spacer to separate them. This adds shadow lines and allows for expansion.

FLUSH-TRIM WOOD PLUGS



I A flush-trim saw cuts plugs flush without marring the surrounding surface. Then smooth the plugs by finish-sanding.

grit and stain, if desired. (See details in **Step 8** below about the stain we selected.)

6 Attach one narrower outside slat (D), with the rabbeted edge up, using $\frac{3}{4}$ " brads. Then attach two-thirds of the remaining slats, separating them with a $\frac{1}{8}$ -thick spacer [Photo H]. (A crafts stick will work.) When you get to the last six slats, space them evenly apart within the remaining space and nail in place.

7 Buy or make $\frac{3}{8}$ " wood plugs $\frac{1}{2}$ " long, and glue them in place over the screws. Cut the plugs flush with a sharp chisel or saw [Photo I] and sand smooth.

8 Finish-sand parts to 220 grit. Apply stain, if desired, and a clear finish. (We used Minwax no. 607 Cherrywood gel stain to lessen blotching, followed by two coats of wipe-on polyurethane.)

Written by **Bob Wilson** with **Kevin Boyle**
Project design: **Roger Keindel**
Illustrations: **Roxanne LeMoine; Lorna Johnson**

Cutting Diagram



$\frac{3}{4}$ x $7\frac{1}{4}$ x 96" Cherry (5.3 bd. ft.)

*Plane or resaw to the thickness listed in the Materials List.



$\frac{3}{4}$ x $7\frac{1}{4}$ x 96" Cherry (5.3 bd. ft.)



$\frac{3}{4}$ x $3\frac{1}{2}$ x 24" Cherry (.7 bd. ft.)



1" diam. x 36" Cherry dowel (2 needed)

SHOPTIPS 54 & 55

Cover up screws with these two accessories

Countersink/
counterbore

Plug cutter



Two low-cost drilling accessories help you hide the screws used to assemble this shelf. The $\frac{3}{8}$ " countersink/counterbore bit (see **Sources** below) drills a counterbore, a countersink for flathead screws, and a pilot hole in one pass to save time and increase accuracy.

To fill the counterbore, make plugs in scrap using a plug cutter made for use in handheld drills. Then saw or pry the plugs loose.

Materials List

Part	FINISHED SIZE			Matl.	Qty.
	T	W	L		
A sides	$\frac{3}{4}$ "	6"	20"	C	2
B shelf	$\frac{3}{4}$ "	5 $\frac{3}{4}$ "	32 $\frac{3}{4}$ "	C	1
C top	$\frac{3}{4}$ "	7"	38 $\frac{1}{4}$ "	C	1
D* back slats	$\frac{1}{4}$ "	2"	9 $\frac{1}{4}$ "	C	19
E towel bars	1" diam.		33 $\frac{1}{2}$ "	C**	2

*Parts initially cut oversize. See instructions.

**Use birch if cherry dowels are unavailable.

Materials key: C=cherry

Supplies: #8x $\frac{1}{2}$ " flathead wood screws, #16x $\frac{3}{4}$ " brads.

Bits: $\frac{3}{8}$ " straight bit, $\frac{1}{4}$ " rabbeting bit, 1" Forstner bit.

Sources

Countersink/counterbore bit: #8 countersink no. 50J04.08, \$8.20, Lee Valley, 800-871-8158 or leevalley.com.

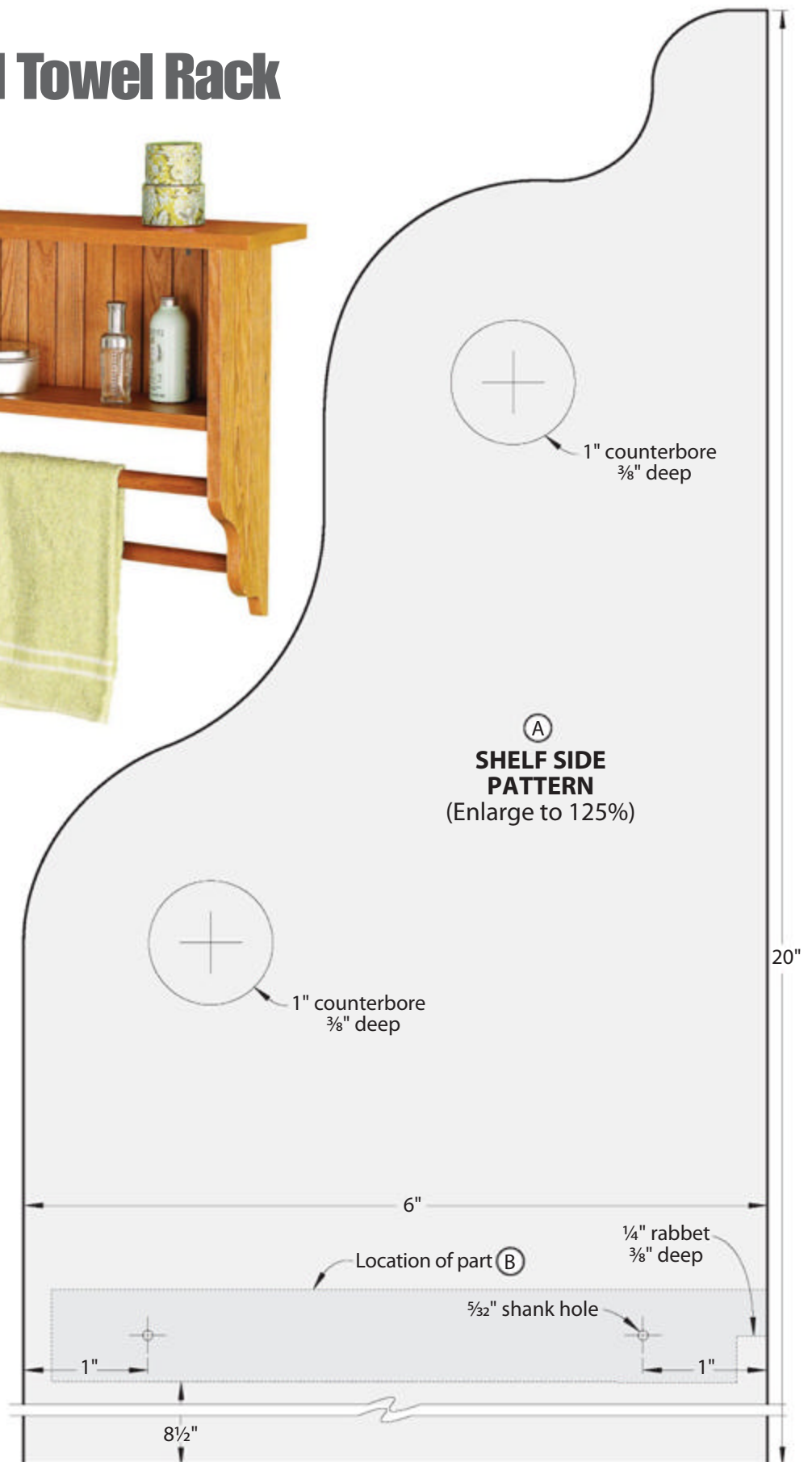
Plug cutter: Self-centering $\frac{3}{8}$ "-diameter plug cutter no. MBT-0375, \$16.85, McFeely's, 800-443-7937 or mcfeelys.com.

project pattern for Wall Shelf and Towel Rack



Use this pattern to complete the Wall Shelf and Towel Rack project beginning on *page 80*. Enlarge to 125% to create a full-size pattern.

Got a woodworking question you need answered quickly? Visit woodmagazine.com/forums



SPECIAL 30-PAGE SECTION

MORE GREAT SHOP TIPS

save **time**, save **material**, and save **dollars** in the shop

Over the past 30 years, we've met a gaggle of friendly pros who love to share their favorite woodworking secrets. In this section, we've organized their best ideas into five categories—perfect for you to page through and cherry-pick tips for your shop and projects.



Tablesaw tips, page 86



Tips for shop success, page 102



Building square projects, page 110



Router tips, page 92

26 tablesaw tips, tricks & techniques



If you think of your tablesaw as a machine for simply ripping or crosscutting, you're selling it short. To give you a fresh perspective, we mined the minds of the *WOOD*® magazine staff and unearthed their favorite time- and work-saving tablesaw tips. Here's a mother lode of helpful hints you can put to work in your shop today.

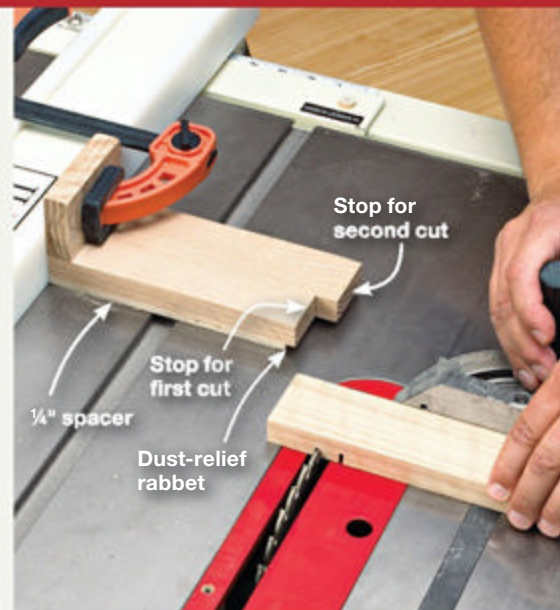
SHOPTIPS 56, 57, 58 & 59

Save time and money by making your saw work smarter

● **Make a quick zero-clearance tabletop.** Instead of crafting a new zero-clearance insert to replace your tablesaw's factory throat-plate insert, create a temporary tabletop, shown *above right*, for your saw in seconds. First, position the fence for the cut you intend to make. Attach a piece of 1/4" hardboard to your tablesaw top with clamps or double-faced tape. Next, raise the blade through the hardboard to the cutting height. Then rip your stock to width.

Note: Blade guards have been removed in these photos for clarity. Always use the appropriate safety guards with your tools.

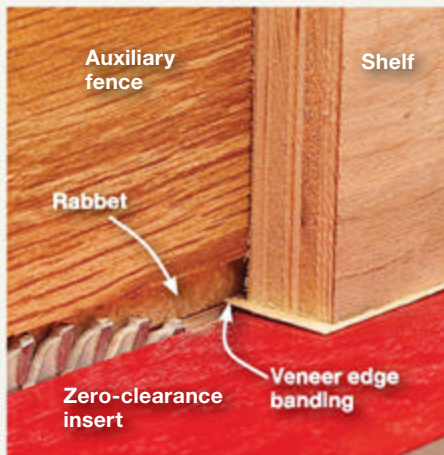
● **Two-step stop defines a dado.** Don't have a dado set? Or do you need to machine a dado wider than your stacked set can handle? You can cut consistently wide slots using this double stop. The distance between the ends of the stops is the key dimension. First, subtract the width of the desired dado from the width of the saw blade or dado set, and then offset the stop ends by that amount. Position the stock against one stop and make the first cut. Reposition the stock against the other stop and make the second cut. (If you're using a single blade, "nibble" away the waste between the kerfs.) To keep the jig accurate, we created dust relief by adding a 1/4" plywood spacer, slightly offset, to the bottom of the fixture.



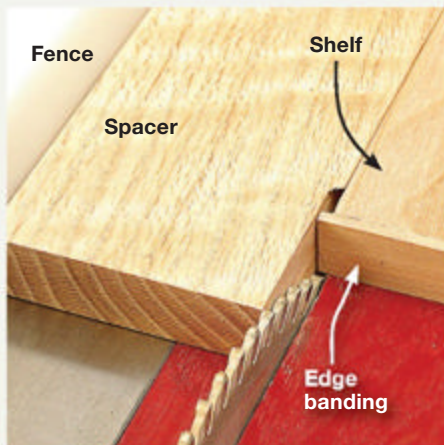
SHOPTIPS 60, 61, 62 & 63

Set up your tablesaw for success

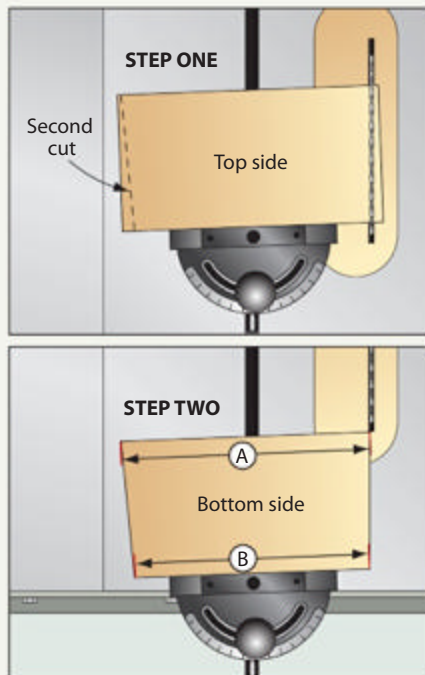
● **Trim edge banding with your tablesaw.** If you're concerned about the stability of perching a router on the edge of a plywood shelf to clean up overhanging edges on solid-wood or veneer banding, then rely on your tablesaw and rip fence. Make an auxiliary fence 4–6" tall and cut a rabbet into its face at least as wide as the blade's kerf. Mount the auxiliary fence to your rip fence and position it so that its face is flush with the outside edge of the blade. (Test the setup by running scrapwood against the fence: If the blade contacts the scrap, nudge the fence closer to the blade and test it again.) Hold the shelf to be trimmed—banding down, with the excess edging in the rabbet, as shown *below*—and trim it flush. For best results, use an 80-tooth carbide blade and zero-clearance insert.



● **Trim edge banding: the sequel.** Use a similar technique to flush-trim the excess length from solid-wood edge banding. This time, though, cut a notch just a whisker wider than your saw blade in a scrapwood spacer, as shown in the photo *below*. Again, position your fence so that the spacer's outside edge is flush with the outside of the blade, and make a test cut. Trim off the end of the banding.



● **Calibrate your miter gauge, part I.** To ensure that your miter gauge squares with the blade, try this trick. Set it for a 90° cut and crosscut one end of a 6" (or wider) scrap. Flip the scrap top-for-bottom, keeping the same edge against the miter gauge, as shown *below*, and repeat the cut at the other end of the scrap. Now, compare the lengths of the two edges of the scrap using a precision steel rule. If A and B match exactly, your miter gauge is square. If not, adjust the gauge and repeat the test cuts until they are, and reset the 90° stop.



● **Locate the "wide" teeth fast.** With an adjustable dado blade (sometimes called a "wobbler"), it's hard to tell which tooth cuts farthest to the left and which cuts farthest to the right. Find the widest-cutting tooth—or teeth, in the case of the dual-blade adjustable dado shown *below*—using a square. Then label that tooth's post with a permanent marker. Now you can measure from that tooth when setting up your cut.



● **Calibrate your miter gauge, part II.** The tip at *left* doesn't work to check the 45° stop, so do this instead. Lay a reliable framing square on the tabletop as shown *below*, so that the edge of the miter slot aligns with the same dimension marking on both legs of the square. (In the photo, we used the 6" markings inside the square.) Loosen the miter gauge, slide it flat up against one leg of the square, and retighten it. Reset the 45° stop, if your miter gauge has one. See *page 111* for a tip on calibrating a framing square.



● **Leave a perfect footprint.** Cast iron is softer than you might think, and an uneven floor can actually transfer its warp to your tablesaw top. So, after you've found the perfect level spot for your saw, mask off the legs, then spray paint around each foot to mark their locations, as shown *below*. Now you can stow the saw and later move it back to the correct location with confidence.



Add more support and storage to your saw

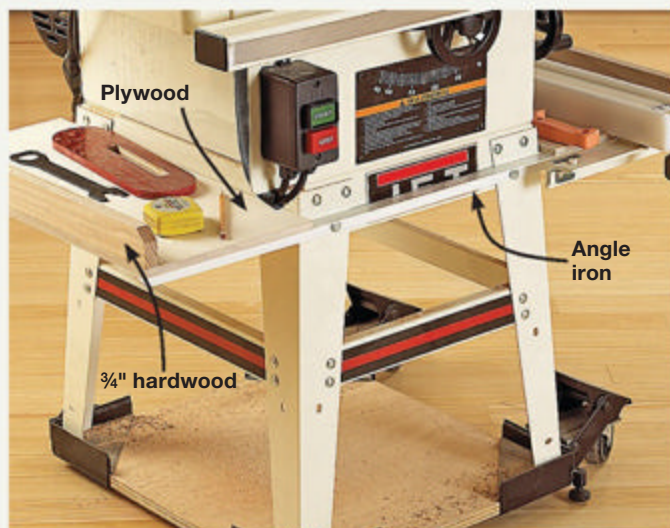
● **Take your outfeed table on the road.** A permanent outfeed table isn't practical in a small shop: You just can't dedicate that much real estate to it. The fold-down outfeed table shown *below* extends 3' of support beyond the blade, yet adds only a few inches of depth to the back of the saw when stowed. And it's always ready, even on a mobile-base-equipped saw. (You'll find plans to purchase this outfeed table at woodmagazine.com/outfeedtable.)



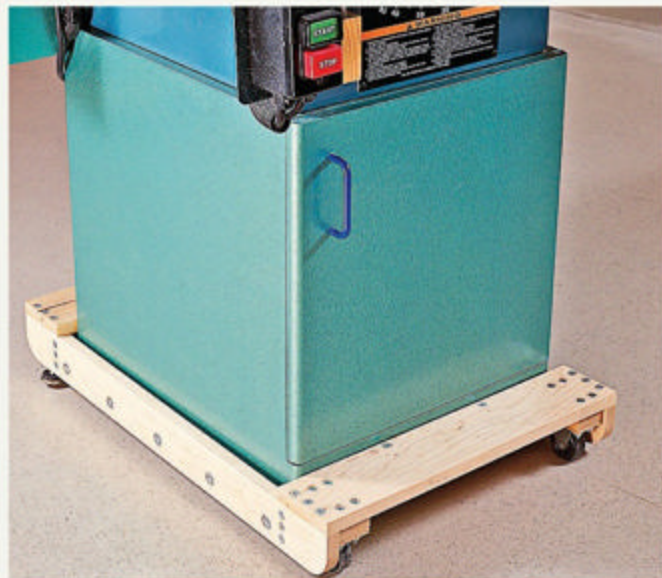
● **Make an instant extension table.** A simple T-shape support, made from scrap particleboard, plywood, or MDF, mounts in your portable clamping workstation, as shown *below*. Once you've matched the support to your table height, drill the base of the support and insert dowels to instantly set the height each time. To make this table even more versatile, use it with your bandsaw and miter saw, drilling separate dowel holes for each height.



● **Put wings beneath your wings.** How do you keep all of those tablesaw accessories close at hand without being underfoot? Take two pieces of 1" angle iron a couple of inches shorter than the width of your saw top and screw them to the front and rear of your contractor-style saw's stand, as shown *below*. Now cut plywood shelves to fit between the stand and the ends of the angle iron, and screw them on top of it (hidden from view). Add a strip of hardwood at the end of each shelf to keep things from falling off, and you gain valuable storage space.



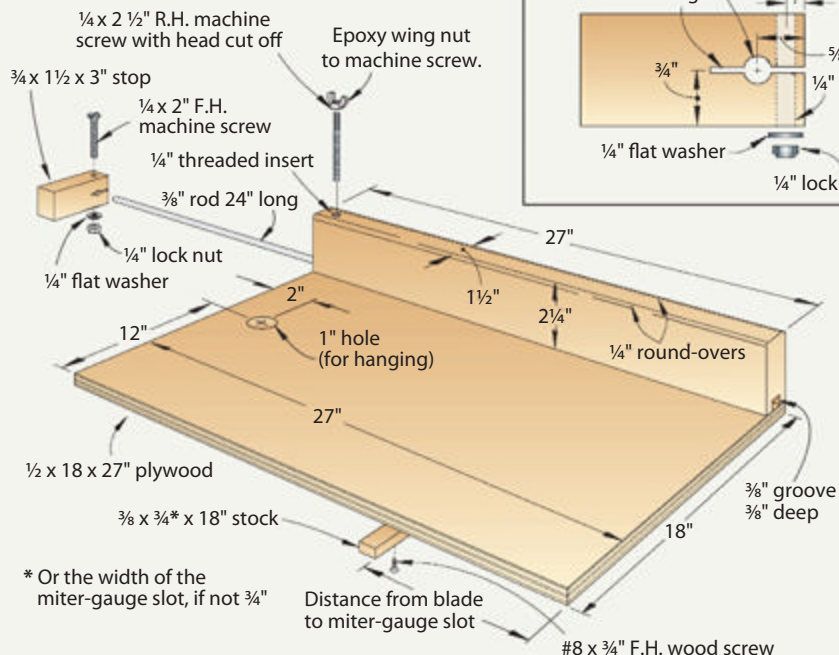
● **Build your own base.** There's no law that says you have to use the steel leg stand that came with your contractor-style tablesaw. Replace it with a simple cabinet, such as the one shown *below*, and not only will you add enclosed storage but also your saw will run quieter. This is a great way to improve dust collection, too. To purchase a downloadable plan for this base, visit woodmagazine.com/tsupgrade.



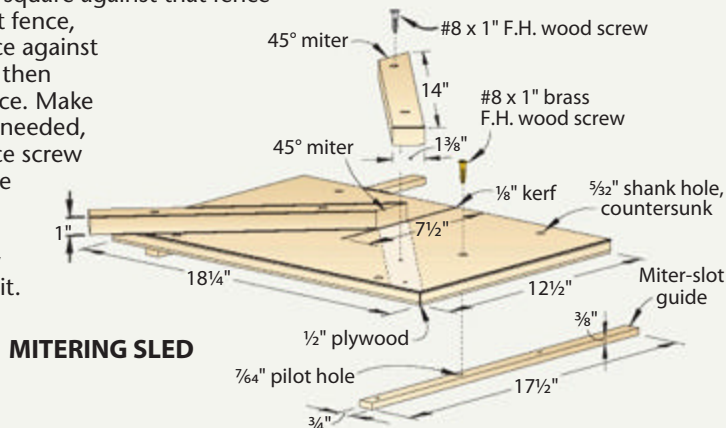
Four simple jigs increase speed and accuracy

● **Make cleaner crosscuts.** A zero-clearance crosscut sled, when paired with a quality blade, virtually eliminates tear-out in veneered plywood, guarantees a square cut, and costs just pennies to make. We spiffed up the sled shown at *right* with an adjustable stop, but that's just the icing on the cake. This fence-forward design allows you to cut wider workpieces than one with the fence closer to the operator. During assembly, locate the miter bar so that about ¼" of the fence will overhang the blade. Before you use the base and sled, run it through the blade to remove this excess and create a zero-clearance edge.

PANEL-CUTTING SLED



• Miter better with a dedicated sled. For perfect miter joints, it's more important that both miter cuts add up to precisely 90° than each miter is exactly 45° . This blade-straddling miter-cutting sled ensures that those complementary cuts always equal a right angle. To install the miter-slot guides on the bottom of the sled, place the guides in your saw's slots, set the sled on top of them, and then drive screws into the guides through the top of the sled. Now cut a blade kerf about halfway across the sled. Using a combination square, mark the location of the right-hand fence 45° to that kerf, and install the fence on that line. Place a reliable framing square against that fence to locate the left fence, rest the left fence against the square, and then screw it into place. Make test cuts, and if needed, remove the fence screw farthest from the kerf, adjust the fence's angle, and drive a new screw to secure it.



MITERING SLED



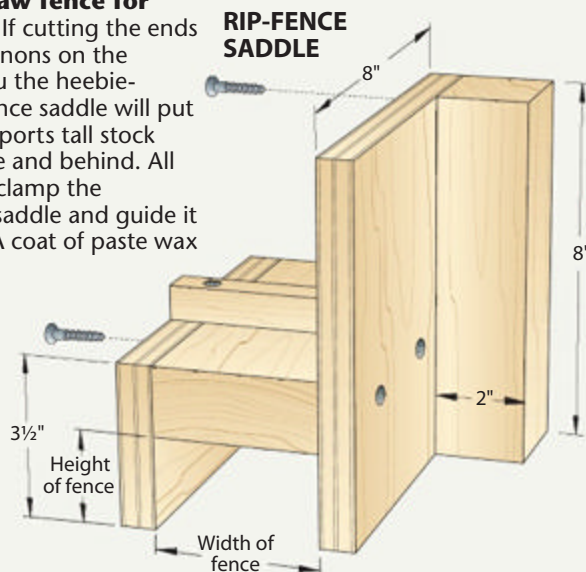
● **Taper with confidence.** You can buy or build more elaborate tapering jigs, but this simple helper *below* will handle most of your tapering chores. It runs in the saw's miter-gauge slot. To use the jig, measure the width of the sled and set your fence that distance from the blade. Remove the top screw, loosen the pivot screw, rotate the fence to match your desired taper, and then tighten both screws. Butt your workpiece against the dowel with one edge against the jig's fence, and then cut your taper.



continued on page 90

continued from page 89

● **Saddle your saw fence for cutting tenons.** If cutting the ends of parts such as tenons on the tablesaw gives you the heebie-jeebies, this rip-fence saddle will put you at ease. It supports tall stock from both the side and behind. All you have to do is clamp the workpiece to the saddle and guide it through the cut. A coat of paste wax on the inside of the saddle where it contacts the fence makes the saddle glide smoothly.



SHOPTIPS 72-81

Practice common (and uncommon) sense

● **Keep it clean.** Before making any cut, clear the tabletop of all scrap wood, tools, fasteners, and other debris. (That includes not using the top of your fence as a tool tray.) These objects not only distract but they also can become missiles.

● **Set the right height.** There are lots of ideas floating around about proper blade height, but Freud's Jim Brewer has the final word, advising that about half the highest tooth should protrude above the workpiece, as shown in photo at right. Brewer emphasizes that the bottom of the tooth should never be higher than the workpiece top.

● **Protect your eyes.** Without face-hugging safety glasses, airborne dust and chips can blur your vision (not good in the middle of a cut), or worse, injure your eyes permanently. A good pair of safety glasses costs less than a visit to the ER, so buy a pair and wear them.

● **Employ a feathered friend.** The fingers of a featherboard handy hold a workpiece snug against the fence so you can concentrate on feeding the workpiece at a steady pace. Mount the featherboard so that the fingers end before the cutting starts, as shown in photo at right, to prevent trapping the offcut and launching it across the shop.



● **When making a through cut, always use the fence or miter gauge, but never both.** Two cuts you should never consider: freehand cutting (with no assistance from the rip fence or miter gauge); and using both the fence and miter gauge to guide a workpiece as shown in photo at *right*. In both cases, the workpiece will likely bind on the blade, sending it flying back at you. (Note: When cutting dados, you may safely use a miter gauge and fence together.)

● **Be alert!** The tablesaw-injury story often begins with, "I was making the last cut of the day..." Fatigue leads to errors in judgment that, in turn, lead to miscut workpieces—or worse. Also, repetitive cutting chores can lull you into carelessness, so take frequent breaks.

● **Don't overreach.** Any time your hands get within 6" or so of the blade, you should hear alarm bells in your head. Keep pushsticks handy and use one to complete the cut whenever your digits get within the danger zone.

● **One-handed bar clamp keeps crosscuts square.** When crosscutting long pieces, it's helpful to have an extra hand to ensure a square cut. Call on a one-handed bar clamp to hold the workpiece tightly against the auxiliary fence as shown in photo at *right*.

● **Use playing cards to micro-adjust your tablesaw fence.** If your tablesaw fence doesn't have a microadjustment knob, you can make finely tuned cuts—if you play your cards right. To make a cut right on the money, make a test cut in scrap and then check the measurement. Then, slide a wooden block against the inboard or outboard side of the fence—depending on which way you need to adjust the cut—and clamp the block to the saw table, as shown in photo at *right*. Next loosen the fence, insert or remove a playing card or two between the block and the fence, relock the fence, and make another test cut.

● **Strike out pitch with Formula 409.** A tablesaw blade gummed up with pitch produces inferior cuts. Although there are specialty blade-cleaning products on the market, Formula 409, a kitchen cleaner, does a great job cutting through the pitch, as shown in photo at *right*. For particularly stubborn pitch deposits, let the blade soak in Formula 409, then scrub the deposits with an old toothbrush. 🍷



Watch a FREE video on tuning your tablesaw at woodmagazine.com/tstuneup

Our 27 best router tips and tricks



See Shop Tip 90 to learn more about this slick way to cleanly and quickly trim edging.

It's easy to understand why **WOOD**® magazine has published hundreds of router tips over the past 30 years: This favorite woodworker's tool also is one of the most versatile in the shop. Here are some of our all-time best router tips.

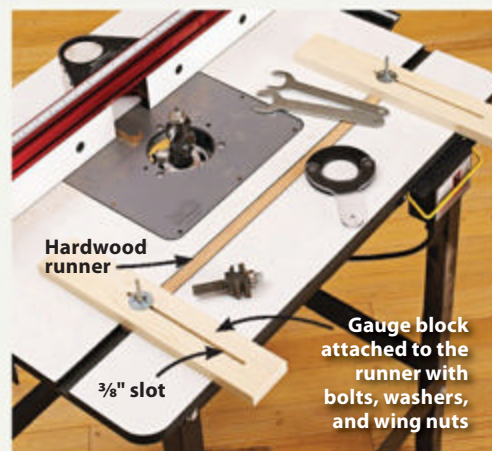


Watch more router-table tips in a **FREE** video at woodmagazine.com/routertips

SHOPTIP 82

Reset a fence quickly

Two-piece rail-and-stile bits use the exact same fence setup for both bits. But that perfect fence location must be disturbed to swap bits. Save time resetting your router-table fence flush with the bit bearing and parallel to the miter slot with this handy gauge. After adjusting the fence flush with the bit bearing and parallel to the miter slot, install the jig in the miter slot. Slide the gauge blocks up to the fence, and tighten the wing nuts to secure the blocks. Then remove the jig, and make your first set of cuts. After you move the fence to change bits, remount the jig in the miter slot. Slide the fence against the blocks, and



tighten it in place. If your router table lacks a miter slot, lengthen the gauge blocks so the hardwood runner rides against the front edge of the tabletop.

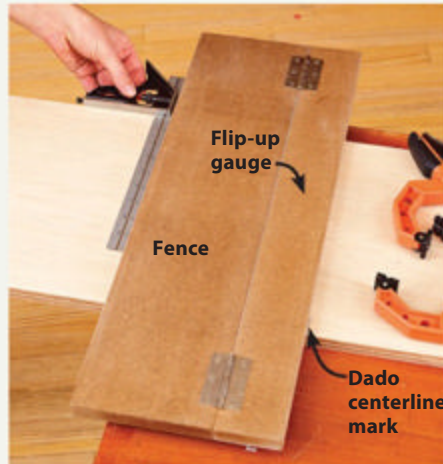
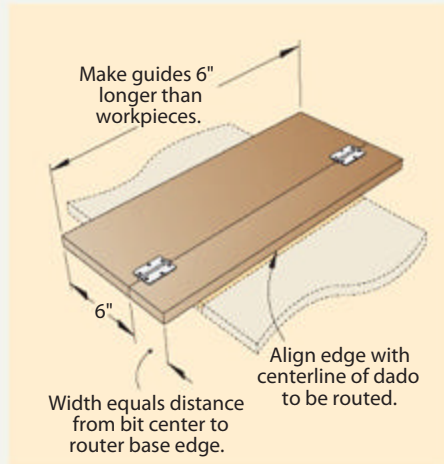
SHOPTIP 83

Hinged jig simplifies routing dead-center dados with straight bit

This guide helps you center a straight bit of any width on the centerline of your dado. Start by ripping two strips from $\frac{3}{4}$ " plywood or medium-density fiberboard to the dimensions shown *below*. With the edges butted tightly together, connect

the pieces with hinges. In your router, mount a straight bit the same diameter as the thickness of the stock going into the dado. Adjust the cutting depth to match the depth of the dado. Mark the center of each dado on your workpiece.

Align the flip-up gauge edge with a dado mark, and square up the jig to the workpiece (*below center*). Then clamp it in place. Flip the gauge up over the fence and use the fence edge to guide the router as you dado-cut (*below*).



SHOPTIP 84

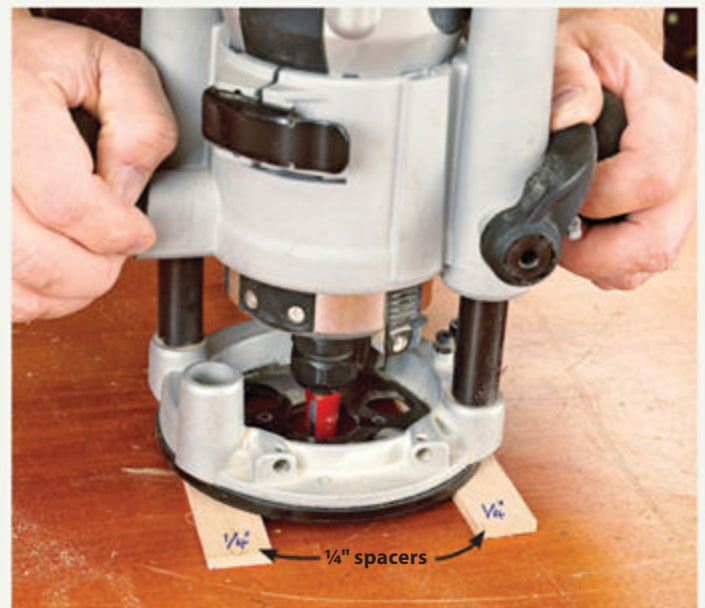
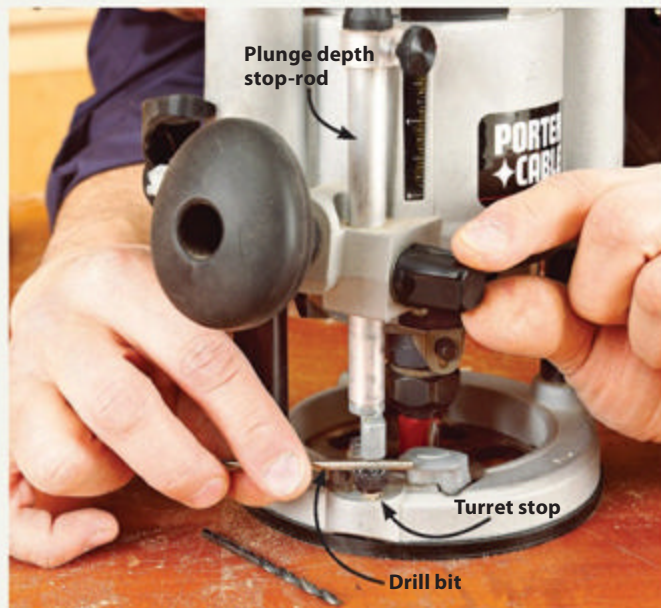
A pair of paths to precise plunges

You can fuss with rulers and depth gauges all you want, but here are two quick and easy ways to precisely set your plunge-router cutting depth.

The method shown *below* uses a drill bit to exactly set a router's plunge depth. First, place the router on your bench and lower the bit until it touches the benchtop.

Then lock it in place. Loosen the depth stop-rod, and sandwich a drill bit of a diameter equal to the plunge depth between the turret stop and rod. Then tighten the stop-rod in place. Unlock the plunge mechanism, and you're ready to plunge into your project at the required depth.

The method *below* uses spacers planed to the same thickness to determine the depth of your plunge cuts. Place the router on a pair of spacers, and lower the bit until it touches the benchtop. Lower and tighten the stop-rod against the turret stop. You're now ready to rout.



SHOPTIP 85

Tape your way to tighter dados

Adjusting a jig or straightedge to widen a dado just a hair can create more problems than it solves. Instead, leave your guide in place and add strips of tape along the router-base edge, as shown *below*. That nudges the bit away from the guide when you recut. Four layers of blue painter's tape adds up to about $\frac{1}{64}$ ".



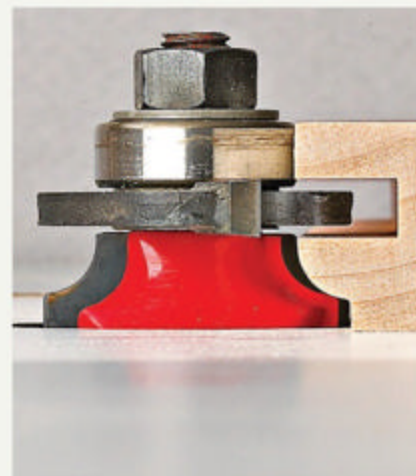
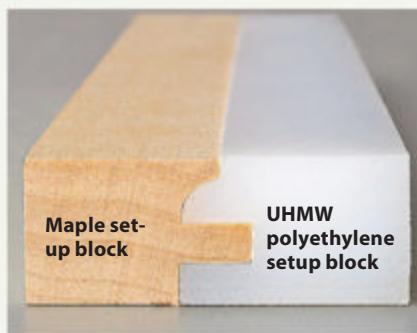
SHOPTIP 86

Gauge blocks simplify bit setups

Have you ever painstakingly set a bit height, only to find that you needed to return to it later? Making gauge blocks for rail-and-stile, raised-panel, finger-joint, and profiling bits saves setup time. You can rout them from medium-density fiberboard or hardwood, but ultra-high molecular-weight (UHMW) polyethylene, shown *below*, makes a more stable block. (Sheet $\frac{3}{4}$ "x4"x48", item no. 124228, about \$40, from Woodcraft, 800-225-1153 or woodcraft.com.)

From stock planed to the same thickness as your project parts, cut blanks at least 4" wide and 6–8" long. Next, set up the bit in the router table and make test cuts in scrap to fine-tune the height. After routing project parts, rout the same profile on a

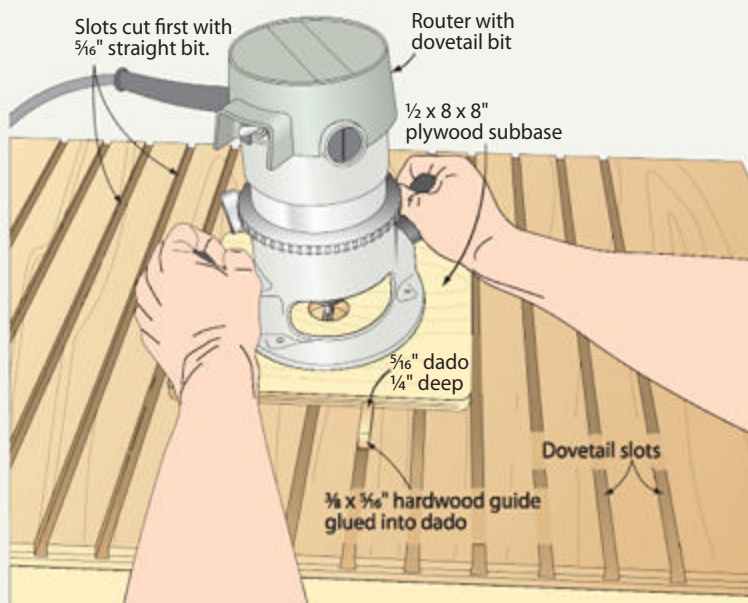
gauge-block blank. Repeat for the mating bit, if needed. Then rip the gauge blocks to about $1\frac{1}{2}$ " wide, and label them with the bit profile and stock thickness. To use the gauge blocks, chuck a bit into your table-mounted router and raise the bit to roughly the correct height. Place the gauge block with the mating profile beside the bit. Then raise or lower the bit until it slides into the routed profile on the block, as shown *below*. Lock the height. You'll still need to test-cut scrap for a dead-on fit, but the gauge blocks will make that go a lot faster.



SHOPTIP 87

Jig simplifies parallel passes

Whether you're routing dovetail slots, as shown at *right*, or T-slotted wall-storage-system panels, here's a time-saving jig for you. It indexes from the previously routed slot to ensure evenly spaced dados, dovetails, and grooves. From scrap $\frac{1}{2}$ " plywood, cut a subbase to fit your router and project. First, rout a dado on the subbase bottom where the distance between the dado and the bit equals the spacing between the slots. Make the dado as wide as the bit profile at the workpiece surface. Then attach a matching hardwood guide in the dado. For grooves deeper than $\frac{1}{4}$ ", make progressively deeper cuts. For dovetails, rout first with a straight bit, and then finish with a dovetail bit for efficient chip removal.



SHOPTIP 88

Route stopped cuts with stopblocks

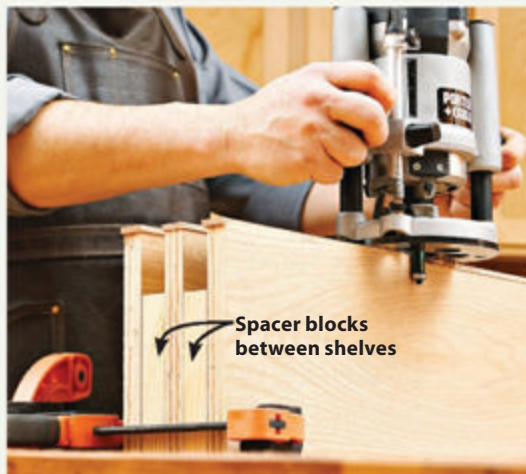
Edge cuts, including chamfers, and surface profiles, such as flutes, sometimes need to start and stop precisely and uniformly. That's the time to use simple, customized stopblocks to control where the profile starts and stops on each workpiece. Measure from the point where the cut will stop to the end of the workpiece, subtract the bearing radius, and cut the stopblock to that length from scrap at least $\frac{3}{4}$ " thick. Clamp the stopblock to the edge of the workpiece as shown.



SHOPTIP 90

Shelf-help for trimming edges without tipping

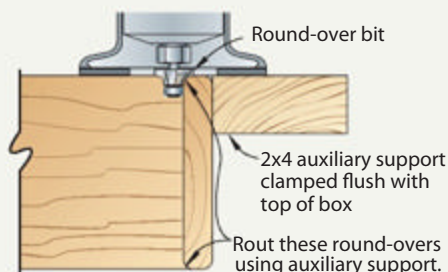
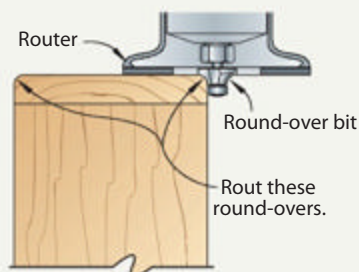
Perching a hand-held router on a shelf edge to flush-trim solid-wood edges can turn ugly if your machine tips. Give your router stability by clamping together the shelves on edge. Cut spacer blocks from 2x4 scrap and place them between the shelves at both ends. Then clamp the spacers and shelves together. (We clamped one of those clamps to the bench for added stability.) Route each edge with a flush-trim bit. If the router wobbles on the edges of the outside shelves, move those pieces to the inside, reclamp, and finish routing.



SHOPTIP 91

Route round-overs, not tip-overs

A tipping router can ruin the edge of a finished project, so keep that base stable. If you need to round over the outside edges of an assembled box, tip the project on edge and use the front, back, and sides to support the router base, as shown *below left*. To rout inside round-overs with equal ease, clamp a 2x4 auxiliary support onto the outside surfaces, as shown *below right*.



SHOPTIP 89

Get a grip on small parts

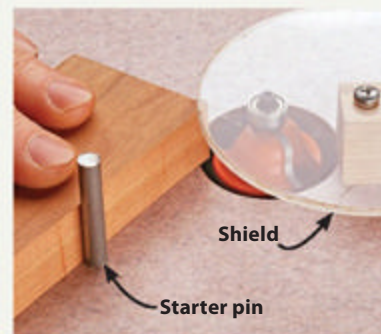
Small parts can drop through oversize router-table inserts or instantly tug fingers into the bit. To solve both problems, first drill a hole slightly larger than the bit diameter in a piece of $\frac{1}{4}$ " plywood. Then clamp it to the router-table top for near-zero-clearance support. Keep your fingers safe by gripping the part with a hand-screw. The jaws of these clamps can be angled to firmly grasp odd-shape parts and hold them flat against the zero-clearance top.



SHOPTIP 92

A starter pin prevents grabbing and kickback

The toughest part of freehand routing is easing the workpiece against the bit. To help you guide parts safely, make a starter pin from a hardwood, brass, or aluminum rod, and securely mount it to the table about 2" from the bit. Brace the workpiece against the starter pin; then slowly rotate it into the bit and bearing. Grip the workpiece close to the pin, and use the above technique for small parts.



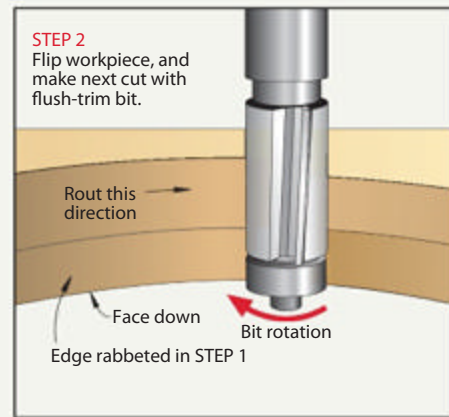
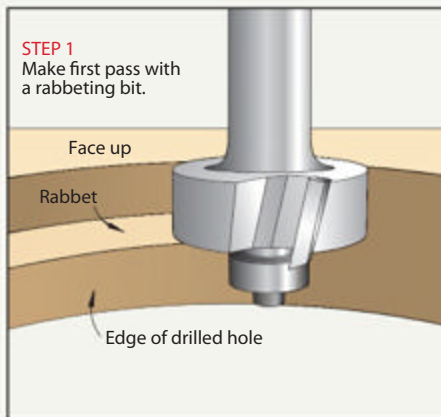
SHOPTIP 93

Enlarge holes precisely in two easy steps

Maybe you need to enlarge a hole, or make a dead-on round hole larger than your largest Forstner bit. Do either using a rabbeting and a flush-trim bit.

To enlarge a hole's radius by $\frac{1}{4}$ ", first rout a $\frac{1}{4}$ "-deep rabbet the width of your cutter while keeping the bearing against the edge of the hole. This creates the "step" shown at *near right*.

Next, turn the workpiece upside down and install a flush-trim bit. Adjust the cutting depth so the bearing rides along the cut made by the rabbeting bit and rout away the step, as shown at *far right*.



SHOPTIP 94

Router templates help master complicated curves

Templates needn't always follow straight lines and simple curves. They also handle more complex shapes as long as the template corners aren't tighter than the diameter of your router guide bushing.

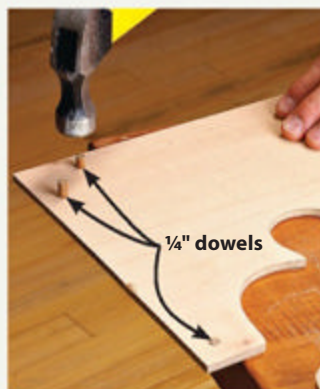
This reversible template lets you rout mirror-image patterns, as on this shelf bracket. With a different pattern, you could rout matching tambour-door tracks in the inside faces of a rolltop desk or a countertop kitchen appliance holder. There's only one requirement: The workpiece should have at least one straight edge to align the template.

Make templates from $\frac{1}{4}$ " plywood or veneered medium-density fiberboard, leaving an extra $\frac{3}{4}$ " of material on two adjacent edges. Size and shape the template to allow for the diameter of the guide bushing. With the template in position on the workpiece, trace the reference edges of the workpiece onto the template bottom.

Then flip the template over and, along each line, drill two $\frac{1}{4}$ " holes so their edges just touch the line. Then cut four $\frac{3}{4}$ " lengths of $\frac{1}{4}$ " dowel and insert them into the four holes.

Dowels should fit snugly enough that they don't fall out, but not too snug to tap through the template. For a tight fit, moisten dowels and allow them to dry before inserting them in the template.

Choose a bit that creates the pattern you want, and attach a guide bushing sized to accommodate the router-bit diameter and the desired offset from the template. To register the dowels against the workpiece, first tap the dowels flush with one side of the router template before you clamp on the template. Rout the pattern, as shown *below left*. Then flip the template over, tap the dowels flush with the opposite surface, as shown *below right*, and rout the mirror version of the first path.



SHOPTIP 95

Rout corners consistently

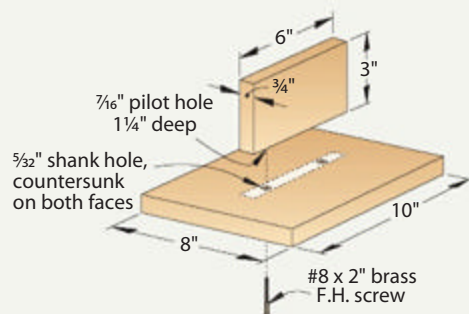
Rounding over corners by hand-sanding produces uneven results. Instead, use a round-over bit with the radius you want for your corners. With the bit chucked on a table-mounted router, raise the bit height until it cuts a quarter-round profile in scrap without leaving a shoulder. Then position the fence flush with the bit pilot bearing. To prevent chip-out and keep the frame square to the fence and router-table top, clamp the piece to a 2x4 backer block, as shown *below*.



SHOPTIP 96

To wipe out tear-out, call for backup

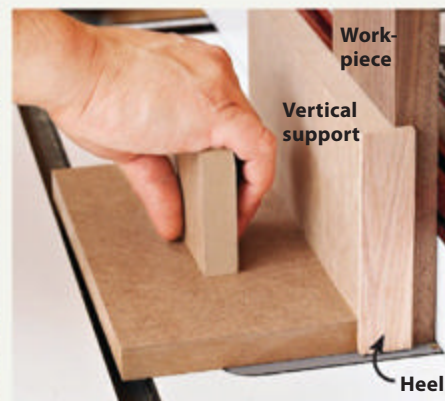
Backer blocks not only reinforce router-table cuts, they also double as miter gauges for keeping parts perpendicular to the fence more reliably than a miter gauge. Use the drawing *below* to assemble a backer block from $\frac{3}{4}$ " scrap sheet goods, or customize it to suit your



needs. One advantage of a base this size is that you can trim away the routed edges and use the block again with a different profile. You also can modify the



block to cut tenons on end by gluing on a vertical support to steady the workpiece and a heel to push it into the bit.



SHOPTIP 97

Router shelf-pin holes with guide bushing and bit

The downside to making adjustable shelving is drilling the shelf-pin holes consistently. With this template, however, you can bore clean, precise holes time after time using a plunge router with a guide bushing and straight bit.

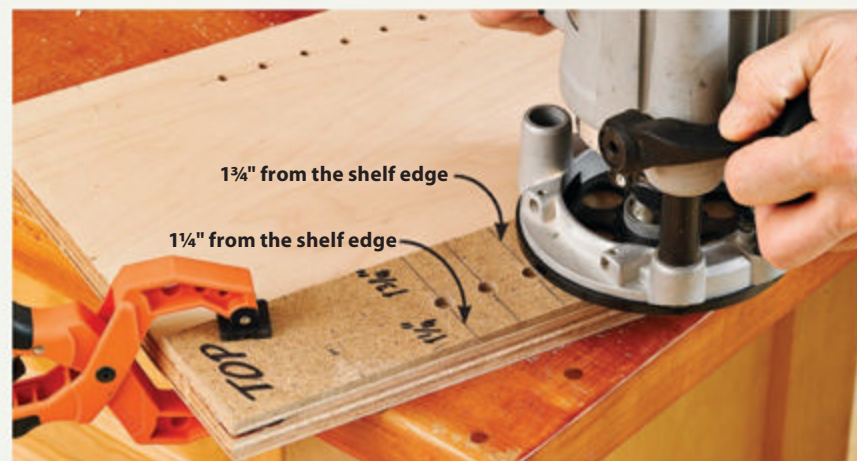
Make the template from a strip of $\frac{1}{4}$ " tempered hardboard that's smooth on both sides. Vary the strip width and length to suit the placement of your shelf-pin holes. For example, the holes in the 3"-wide template *below* are offset to rout shelf-pin holes $1\frac{1}{4}$ " from the shelf edge on one side and $1\frac{3}{4}$ " on the other. Then use a drill press with a brad-point bit to bore evenly spaced $\frac{3}{8}$ " holes. (If you're off

a hair, referencing the router template from the same end of the workpiece every time ensures stable shelves.) Then clamp the template onto the case side.

Mount a $\frac{3}{8}$ " guide bushing onto the router base. (If the bushing extends past the template bottom, file the bushing flush.) Install a $\frac{1}{4}$ " straight bit into your router, and set the plunge depth to allow for the jig thickness.

At each hole in the template, insert the guide bushing and plunge-cut a hole. Then move to the next hole and repeat until you're finished.

To see a free video on using this template to drill shelf-support holes, visit woodmagazine.com/shelfholes.



SHOPTIP 98

For precision mounting, photocopy router base

Mounting jigs or subbases onto a router, like the one shown in **Shop Tip 87**, requires precise mounting holes. Make that job easier by photocopying the router base and using the copy to mark and drill mounting holes. Check the copy size against the base size in case the copier is off slightly, and reduce or enlarge it as needed. If you have a computer scanner, you also can scan the base and file the scan for future printing.



SHOPTIP 99

Spacers divide raised panel cuts

Routing raised panel edges in one pass produces tear-out and it's risky. Spacers taped to a router-table fence let you rout gradually without constant adjustments. First mount a panel-raising bit onto a table-mounted router set to its lowest speed. Test-cut scrap the thickness of the panels to set the final profile. Then make eight spacers from $\frac{1}{8}$ " or $\frac{3}{16}$ " plywood, and double-face tape four on each side of the router-table fence. Rout all four edges of each panel, starting with the ends; then use a putty knife to pry off a spacer from each side, as shown *below*. Repeat for each panel, removing pairs of spacers until the panel rides against the fence on the final pass.



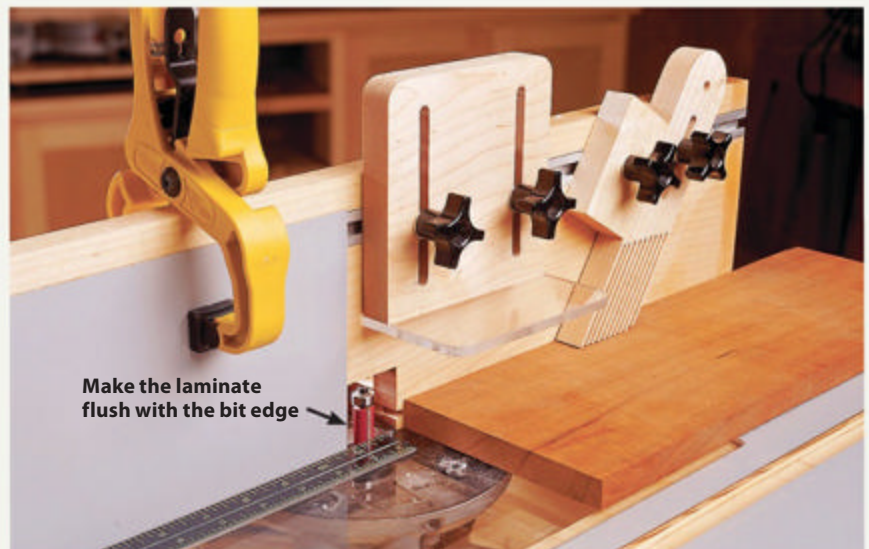
SHOPTIP 100

Joint boards the easy way on a router table

No jointer? No problem. Plastic laminate clamped to the outfeed side of your router-table fence works the same as the outfeed table on a jointer. Cut laminate to fit the left side of the fence; then sand a chamfer on the edge nearest the bit to avoid snagging your workpiece.

Use a straightedge to adjust the fence. The laminate should be flush with the cutting edge of your installed

flush-trim bit raised to cut the full width of the workpiece edge. Start the pass by pressing the workpiece against the right half of the fence; then slide it from right to left. As it clears the bit, shift pressure to your left hand to press the trimmed portion against the laminate to finish the cut, which trims about $\frac{1}{16}$ " with each pass. Laminate thickness must equal the depth of the cut.



SHOPTIP 101

Remove edge-banding with a router

Balancing a router with a flush-trim bit along a workpiece edge as you remove excess iron-on edge-banding can ruin a shelf with the slightest tip. But a router with a $\frac{1}{4}$ " straight bit and this jig trims edging without risking gouges. To make this jig, cut an 8" square base from $\frac{1}{2}$ "-thick medium-density fiberboard (MDF) or plywood. Then cut a $\frac{1}{4}$ "-deep kerf centered on the bottom. From $\frac{3}{4}$ " plywood or MDF, cut a $3\frac{1}{16} \times 8$ " fence, and glue it to the base flush with the kerf, as shown at *near right*. Using a $\frac{3}{4}$ " plywood scrap to stabilize the base, drill a $\frac{3}{4}$ " centered hole with a Forstner bit.

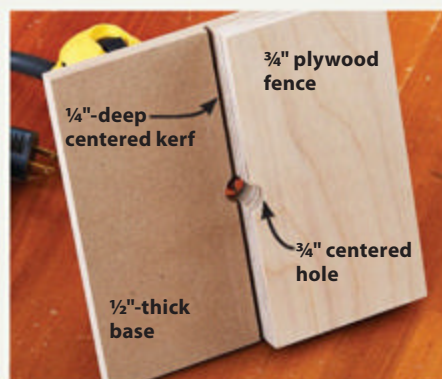
Next, insert a $\frac{1}{4}$ " straight bit in your router. With the bit centered in the hole (and the kerf), mount the router to the jig with double-faced tape. Then adjust the bit depth so the tip comes to just below the bottom surface of the base. Test the setting

on plywood scrap to make certain the bit doesn't leave score marks on the surface.

To trim edge-banding, clamp the workpiece into position, as shown *below right*. Push the jig base firmly against the workpiece surface and edge with the surplus edge-banding inside the kerf. Turn on the router, slide the jig along the banded edge, and trim off the

overhanging edge-banding. Edge-banding still proud of the surface can be sanded away with 180-grit abrasive.

The heat from the spinning bit may reactivate some of the edge-banding adhesive, causing it to stick to the bit. Remove it immediately with a blade and bit cleaning fluid, available from most woodworking specialty stores.



SHOPTIP 102

Find your optimum speed for safe, clean cuts

Because bit diameter largely determines the best router speed, you can chart some general guidelines, as shown at *right*. If your router's speed dial features only single numbers or letters with no obvious reference to speed, use the following technique to find the optimum speeds for your router bits. Chuck a bit and slowly ramp up the speed until the router begins to vibrate, then back it off until the vibration disappears. Make note of that setting in the third column of the chart at *right* for future use with that particular bit. Use this as your starting point; then fine-tune the speed based on the router or materials you're working with.

- When routing cherry and hard maple, slow the bit speed even more for these burn-prone species.

- Make practice cuts in scrap stock, especially when using an unfamiliar bit, router, or material.

- When routing highly figured wood, slow the speed a little more to avoid tearing out wild grain.
- Maintain the same approximate feed rate. Varying the feed rate could affect the cut quality, just as if you had increased or decreased the bit speed.
- When routing in trapped cuts (dadoes, mortises, or dovetails, for example), slower speeds help reduce burning, particularly when the bit can't expel the chips easily.
- Try to finish each task with a light cut ($\frac{1}{32}$ " or less) to get the best cut quality, just in case your speed proves a little too fast or slow.

Use this reference chart as a starting point to find the best speed for the specific bit and task you're working on. If your router's speed dial does not indicate actual rpm, write the corresponding dial marking under "My router" next to the speed you want. Keep a chart for each router.



Router-bit speed chart

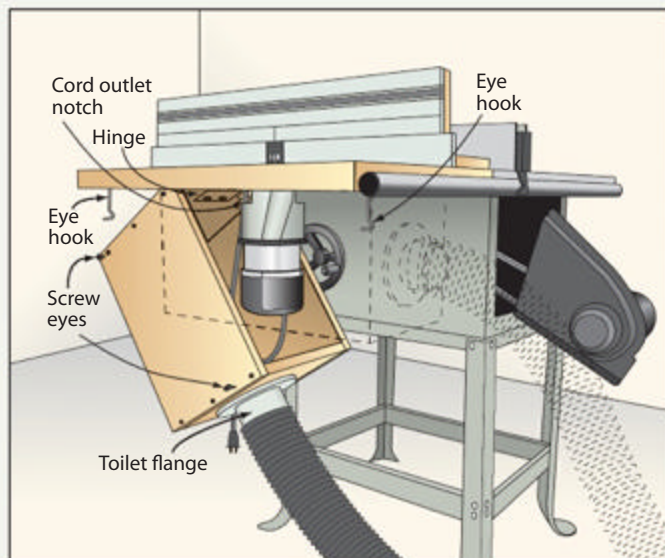
Bit diameter	Max. speed × 1,000 rpm	My router
up to 1"	24	
1½–2½"	16–18	
2⅝–3"	12–14	
3⅞" or larger	10–12	

SHOPTIP 103

Router house defeats dust problems

After mounting my router in the extension of my tablesaw, I needed a dust-collection solution that allows easy access to the router for bit-height adjustments. The box shown here encapsulates the router and allows the dust collector to create the necessary vacuum pressure to work well. I used a 3" O.D. (outside dia.) PVC toilet flange to create the dust-collection connection. A hinge secures one end of the housing, and a set of hooks and eyes holds the box open for router access or closed for operation.

—Steve Conway, Oakdale, Minn.



SHOPTIP 104

Safely rout on a narrow edge

Here's a simple way to support your router when machining the edge of a part in an assembly. Clamp a 1½"-wide scrap (a 2×2 works great) of the needed length to the part, flush with the edge, as shown. The scrap provides additional support for the router base to ride on, allowing you to keep the router stable and make a straight cut.



SHOPTIP 105

Joint boards for gap-free edge-gluing

No matter how straight a board looks in the home center, it's likely not straight enough to edge-glue without leaving unsightly gaps that weaken the glue joint. To make those edges true as can be, turn the other edge of your circular-saw guide (**Shop Tip 110**, page 103) into a router guide. Then straighten or "joint," boards using a 1/2"-diameter straight bit or spiral bit. (Remember to use the same bit diameter for future edging.)

1 With the straight bit installed, measure from the edge of the bit to the edge of the router base.

2 Along the length of the guide's base, mark a line that distance from the fence. Saw off the excess base to within 1/8" of the waste side of the line.

3 Adjust the router-bit depth to cut just deeper than the thickness of the base [**Photo A**]. Then, clamp the guide to the sawhorses to keep the guide from shifting. While holding the router base tight against the fence, rout the rough edge smooth. Label the router-guide side with the router used (if you have more than one), and a reminder arrow showing the correct router travel direction [**Photo B**].

4 To joint a board for a glue-up, place the guide-base edges near the edge of your workpiece, leaving a strip about 1/8" wide to be routed straight. Clamp the guide in position, and rout the board [**Photo C**]. If your tablesaw can handle the size workpiece you're jointing, place the routed edge against your tablesaw fence, and cut a straight and parallel edge on the opposite side. Otherwise, move and reclamp the guide to rout that edge, as you did the opposite one. You also can use this technique to remove rounded factory edges from 2x4s.



SHOPTIP 106

Solve sticky router problems

When you're swapping between fixed and plunge bases on a multi-base router kit, fine sawdust (especially from MDF) packed in the motor's spiral grooves may make it difficult to remove the motor from the plunge base. Start by trying to remove as much dust as possible using compressed air. An aerosol penetrating oil or WD-40 also may loosen up the jam, although you'll later have to remove all lubricant from the motor housing and base to avoid attracting more contaminants.

Another possible cause for this type of jam: Transferring the motor between bases may have accidentally nicked the motor housing, raising a burr that keeps the housing from turning inside the base. If you spot a small nick or raised sliver of metal, carefully remove it with a fine mill file or a piece of sandpaper.

While you're at it, check for other possible contaminants that may cause the housing to stick in its base. These include errant dabs of glue on the motor housing or wood chips in the grooves.



SHOPTIP 107

Rout perfect-fit dadoes first time, every time

Rout dadoes of any width using what may be the world's simplest jig. It works with any straight bit that is slightly narrower than the thickness of your stock.

From $\frac{1}{2}$ " or $\frac{3}{4}$ " MDF, cut two jig top pieces the same size, as shown at *right*. Make both about 6" longer than the path of your dadoes. Then, cut two cleats 2" wide and as long as the width of the top pieces. Glue a cleat to the underside of each top piece, making each cleat dead-on perpendicular to the long edge. Now, you're ready to dado.

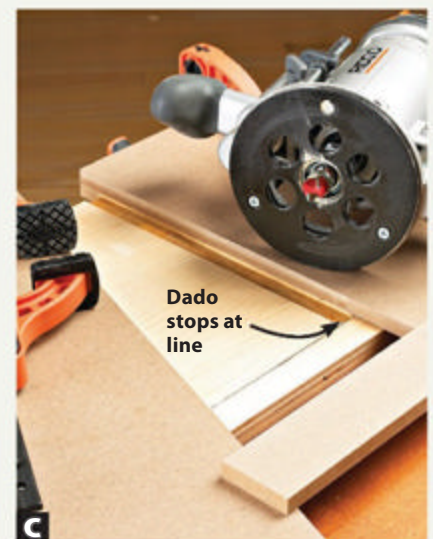
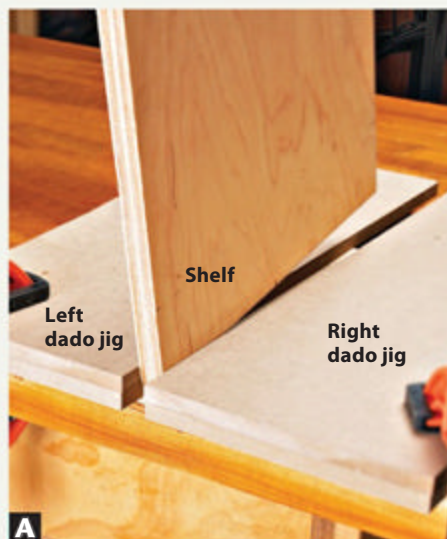
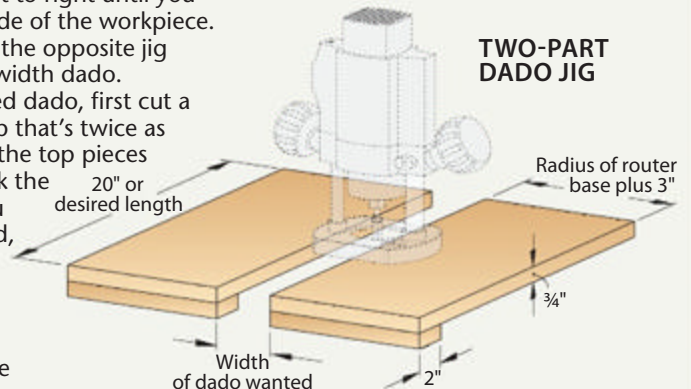
1 Mark the left edge of where you'll dado the workpiece. Then, clamp one jig in place so the right edge of the jig touches the dado mark and the cleat presses against the workpiece edge. Butt the finish-sanded part you'll insert into the dado against the right edge of the jig, and slide the right-dado jig up against the part. Clamp the right-dado jig in place, and lift off the part between the jigs [*Photo A*].

2 To dado the workpiece, install a $\frac{1}{2}$ "-diameter pattern bit (for dadoes wider than $\frac{1}{2}$ ") with a top-mounted bearing and a roughly $\frac{1}{2}$ " cutting depth. (See *Tip 108*.) Make the bit height the depth of your dado plus the thickness of the jig. Press the bit against the edge of one jig just off the workpiece, and turn on your router. Keeping the bit against the jig, work from left to right until you reach the opposite side of the workpiece. Then, repeat against the opposite jig until you have a full-width dado.

3 To make a stopped dado, first cut a third 2"-wide strip that's twice as long as the width of the top pieces to use as a stop. Mark the workpiece where you want the dado to end, then position your jigs, as before. With the dado bit just above the workpiece as the base

rests on the jigs, position the router so the bit just touches the stop line. Using double-faced tape, attach the stop to one of the jigs so the stop is perpendicular to the long edge of the jig and halts the router at the stop mark [*Photo B*]. Set the cutting depth, and rout to the stopblock. Repeat as needed to complete the dado [*Photo C*].

TWO-PART DADO JIG



SHOPTIP 108

Start your router-bit collection with these essentials

Your router-bit investment can add up fast, but it pays to invest in top quality when buying bits you'll use frequently. Whenever possible, buy bits with sturdy $\frac{1}{2}$ " shanks. Here's what to include in a starter set:

- 1** $\frac{1}{8}$ " round-over with a bottom bearing. (It's mounted at the end opposite the shank.)
- 2** $\frac{1}{2}$ "-diameter pattern bit with a 1"-long cutting edge and a top-mounted bearing.
- 3** $\frac{1}{4}$ " round-over with a bearing.
- 4** $\frac{1}{2}$ "-diameter straight bit with a 1"-long cutting edge. Once you step up to a router table, you'll want a similar bit that includes a bottom bearing (complements pattern bit).
- 5** 45° chamfer bit with bearing.
- 6** Rabbeting-bit kit with different-size guide bearings to adjust the depth of cut.



26 tips for all- around shop success

It's great to have a shop full of pro-quality tools, but you don't need them to craft many of the projects featured in this publication. On these pages, we'll show you how to accurately cut, drill, joint, and glue up parts using inexpensive tools and accessories.

For starters, we're going to assume you have at least some common hand tools and measuring devices, and these essential power tools: a bench-top tablesaw, portable circular saw, jigsaw, cordless or electric drill, and random-orbit sander. You'll also need a few inexpensive pipe clamps and budget-priced accessories, such as an \$18 drill guide. Now, let's see how much you can do with so few tools.



See Shop Tip 132 to learn more about setting up power equipment for repetitive cuts

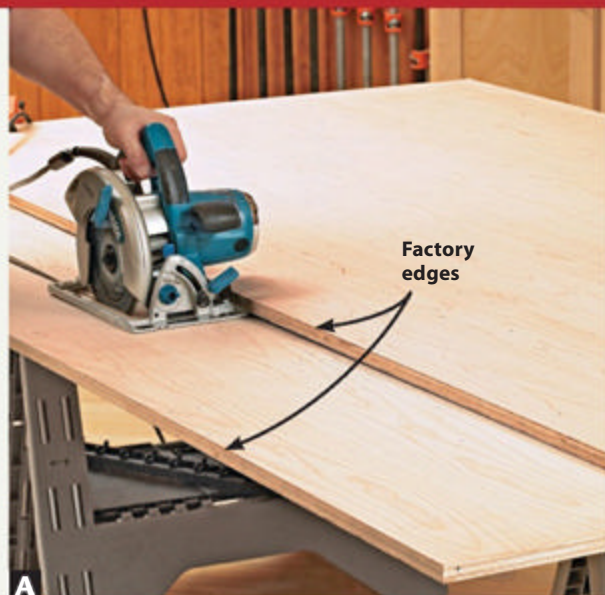
SHOPTIP 109

Add teeth to your circ saw

Most people buy a circular saw for remodeling and construction work, not to make clean, splinter-free cuts for woodworking. If your circular saw produces too much tear-out, replace the original 24-tooth blade with a 40-tooth aftermarket blade.



SHOPTIP 110



Saw arrow-straight lines with a circular saw

Large sheet goods, such as plywood or medium-density fiberboard (MDF), are too unwieldy to cut on a benchtop saw. By making an 8' straightedge, however, you can cut sheet goods precisely using only a circular saw.

1 You need a straight edge to make a straightedge, so either rough-cut a single plywood sheet in half or stagger two sheets so the top sheet's factory edge acts as a straightedge for ripping a 7"-wide strip off the lower sheet [Photo A]. Then, reposition the top sheet's factory edge to rip another strip roughly 16" wide off the bottom sheet.

2 With the circular saw unplugged, measure from the blade to the edge of the saw base beneath the saw's motor. Add up to 1" to that dimension and then screw the 7"-wide strip onto the 16"-wide lower strip that distance from one edge.

3 Place the saw base firmly against the edge of the upper strip (the fence) and cut away the surplus on the lower strip (the base) [Photo B]. Support the waste piece, or have a helper hold it steady to keep the saw from binding. Label the saw side of the straightedge. (You can turn the other side into a router guide; see **Shop Tip 105**, page 100.) If you have more than one circular saw, write on the straightedge the saw make and model so you'll always have protection against tear-out.

4 To cut a project part, clamp the edge of the base onto the pencil marks defining your cutline. Then, run the saw-base edge against the upper strip [Photo C] to guide the cut.



SHOPTIP 111

Adjust blade depth to your stock thickness

We used sawhorses that could be topped with sacrificial 2x4s for cutting and routing sheet goods. If you're using other types of sawhorses, attach replaceable 2x4 tops with fasteners placed well clear of the saw blade. Set the blade or bit to cut no more than $\frac{3}{16}$ " into the sacrificial 2x4s.

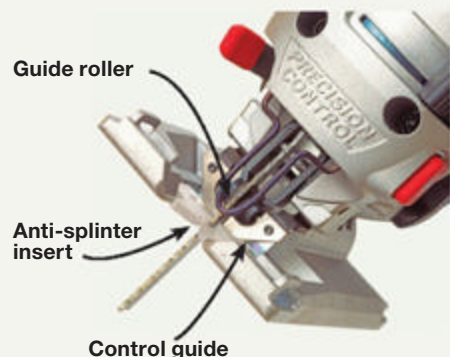


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SHOPTIP 112

Make your jigsaw a curve-cutting specialist

You can't make a good cut with a cheap, down-and-dirty jigsaw, regardless of blade style or quality. A good tool features guide rollers behind the blade to provide support and keep it from deflecting. Some Bosch jigsaws (see *below*) also include precision control guides that contain the blade along both sides. A lock-on button, sawdust blower, variable-speed motor, and straight/orbital cutting options also help deliver a quality cut when matched with the workpiece thickness and material. (The less orbital cutting action, the cleaner

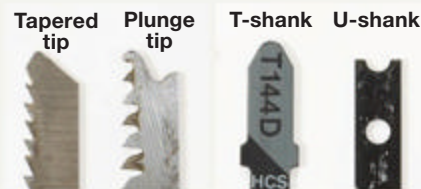


the cut.) Still one more feature is an anti-splinter insert in the baseplate, serving as a zero-clearance subbase.

Select the correct blade

When selecting blades, choose one based on the material you intend to cut, its thickness, and the type of cut. The teeth per inch (tpi) of a wood or plywood jigsaw blade ranges from 6 tpi (coarse) to 20 tpi (fine), with 6-tpi blades being fast and aggressive. Ground, close-set teeth yield clean, precision cuts, while narrow blades excel at turning sharp corners. As the names imply, rely on plunge and tapered-tip blades for specific tasks.

Expect to find two styles of upper-blade ends: T-shank and U-shank. This describes the part that inserts into the tool. The T-shank blades hold more securely in jigsaws that accept them.



Best blade choices

- ① 6 tpi for fast, coarse cuts; ② 10 tpi for straight, fine cuts; ③ 10 tpi reverse-tooth for straight, splinter-free cuts on the surface where the blade exits the workpiece; ④ progressive-tooth with graduating tpi for fast, clean cuts in thick and thin material; ⑤ 12 tpi for narrow, curved cuts in woods; ⑥ 20 tpi for fine, narrow curved cuts in woods and plastics.

SHOPTIP 113

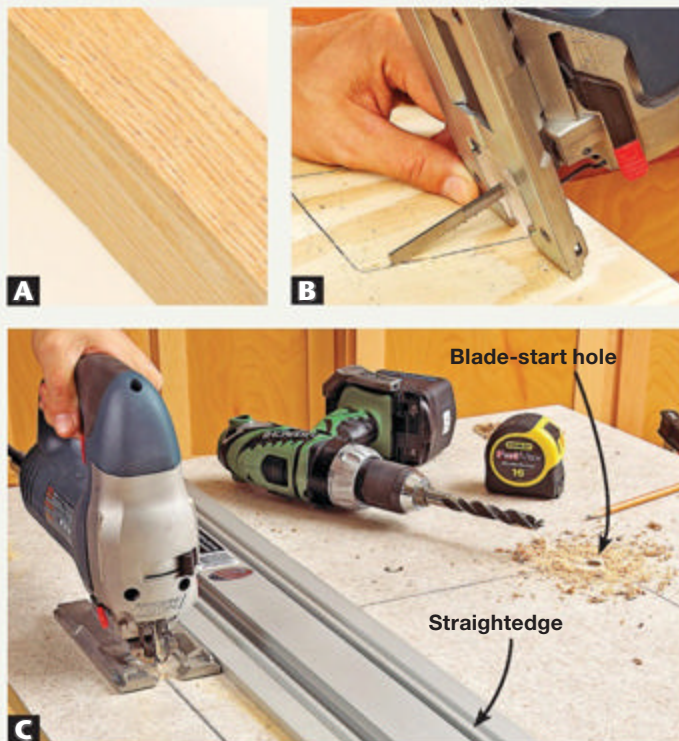
Troubleshooting problems with jigsaw cuts

Blade deflection and saw marks. Deflection occurs when the blade bends to the right or left of the cutline [Photo A], leaving an unsquare edge and, in severe cases, ruining the workpiece. Saw marks leave rough edges. Choosing the right tool and blade are part of the solution, as well as using a straightedge to guide the saw along for straight cuts. When cutting curves, stay $\frac{1}{16}$ " outside the cutline. Clean up curved cuts with a drill-press-mounted sanding drum (concave cuts) or with a disc sander (convex cuts). Or, make a hardboard template of the cut edge and use it, along with a router and flush-trim bit, to true the edge.

Splintering and tear-out. Score and/or tape cutlines, employ backing materials, and use a zero-clearance subbase or anti-splinter insert.

Kickback. Culprits here: binding due to a lack of stock support, wrong blade speed and feed rate, a bent blade, or a hung-up cord. Make practice cuts in scrap to determine the ideal blade speed and feed rate.

Rough field cuts. Simple solutions apply when you cut out an opening in the middle of a workpiece. For fast plunge cuts, insert a plunge-tip blade into the jigsaw, turn on the tool, and slowly tilt the blade into the waste side of the workpiece [Photo B]. For more precision, drill blade-start holes at the opening corners to accommodate the jigsaw blade. Next, clamp a straightedge into place, insert the blade into a hole, and begin cutting [Photo C].



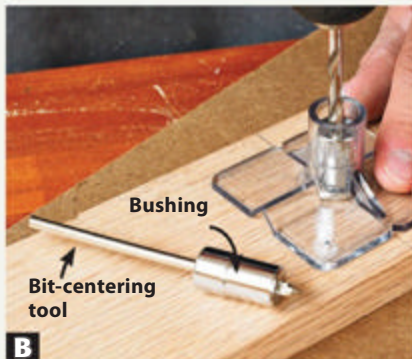
SHOPTIP 114

Bore perpendicular holes without a drill press

Portable drills can't match the accuracy of a drill press for making perpendicular holes, but you can come close using either of these techniques.

A doweling jig [Photo A] (see **Sources** bottom) can double as a drill guide by starting a hole using the appropriate guide bushing. Then, guided by the shallow starter hole, drill through the workpiece.

You also can drill more accurately aided by an \$18 jig [Photo B]. (See **Sources**.) You're limited to bits the same diameters as the six bushings provided, but that's more selection than with the doweling jig. Should you step up to a drill press someday, you still can use this jig to drill into spheres, the sides of dowels, or a workpiece edge.



SHOPTIP 115

Get the (brad) point

Nothing frustrates like watching a twist bit scoot away from the carefully marked location where you meant to drill a hole. With a brad-point bit, however, the tip stays planted where you want it. Start with a basic set, and save them just for woodworking.



SHOPTIP 116

Hone your cornering abilities

Another easy-to-make jig lets you rout identical rounded corners of any diameter time after time. Make the jig from MDF or plywood about 6–8" square. On one corner of the square, use a compass to draw a quarter circle the radius you want. With a jigsaw, cut within 1/16" of the compass pencil mark without crossing it. Use a disc sander or hardwood sanding block to

smooth the curve down to the pencil mark. Then attach a pair of cleats to the edges adjoining the curve, keeping the cleats at least 1" away from where the curve starts.

1 To start, press the jig cleats against the workpiece corner [Photo A], and trace the curve.

2 Jigsaw to within 1/8" of your pencil line [Photo B].

3 Now, turn your jig into a router template, clamping it to the workpiece so your router can move freely around the corner.

4 Adjust a 1"-long pattern bit to make the top-mounted bearing ride against the jig atop the workpiece [Photo C]. Then, rout left to right to remove the rough jigsaw edge.

Be sure to label jigs for future use.



Sources **Doweling jig.** Model G1874, \$39 from Grizzly Industrial, 800-523-4777 or grizzly.com. **Drill guide.** No. 140876 with 3/16", 1/4", 5/16", 3/8", 7/16", and 1/2" bushings and centering pin, about \$18, Woodcraft, 800-225-1153 or woodcraft.com. **Top-mounted bearing pattern bit.** Bit no. 6509 with a 1/2"-diameter by 1/2" cutting height, about \$13, MLCS, 800-533-9298 or mlcswoodworking.com; no. WL-11400 with a 1/2"-diameter by 1" cutting height, about \$16, Woodline, 800-472-6950 or woodline.com.

SHOPTIP 117

Plot your course

Before you cut the first board for a project, review the plans, line up all the materials and supplies, and determine what tools and equipment you'll need. Think about the steps involved and how you'll accomplish them. Then jot down a brief list outlining the order for accomplishing the steps, which you can then use as a checklist. You may alter your work plan as the project progresses, but working from a list of everything you need to accomplish ensures that you don't miss something crucial.

SHOPTIP 118

Make notes, not memories

When a project spreads across several shop sessions, break the work at a logical point whenever you stop. Complete the step you're working on, for instance, instead of stopping in the middle of an operation. Then, write notes on the plans and mark parts so you can easily determine where you left off. You may think you'll remember where you stopped and what you need to do next when you return to the project, but human nature says you won't, especially if the break lasts longer than you plan.

To help keep your shop project on track, check off parts on a cutting list as you make them. Then jot down notes as you work through the steps.



SHOPTIP 119

Clamp and sand panels flat

Purchased lumber can vary enough in thickness to show "steps" on an edge-glued panel. Fortunately, most panels need only one "good" face. To keep at least one surface flat, edge-glue panel pieces with the appearance side down and pressed firmly against the clamp bars or pipes as you apply clamping pressure. (See **Shop Tip 120.**)

1 Cover the clamp bars or pipes with painter's tape where the pieces will rest. That prevents the metal from discoloring the wood and simplifies removing glue squeeze-out.

2 Press the pieces down onto the clamps as you tighten them. Leave the glue-up clamped for an hour, then remove the clamps while the squeeze-out remains soft enough to scrape off. Allow the glue-up to dry overnight.

3 Working only on the appearance side, use a random-orbit sander with 80- or 100-grit abrasive to



level the joint lines, as shown *above*. Avoid creating a trough in the surface above each joint by continually moving the sander and smoothing the entire panel evenly.

SHOPTIP 120

Flat panels on round pipe

You can't be too rich, too attractive, or have too many clamps, but you can have too varied an assortment of clamps. So when you buy pipe clamps, stick to one model. Identical clamps support a glue-up on a flat plane better than a mix of clamps with bars at varied heights.



SHOPTIP 121

Clear the clutter

Few things waste as much shop time or raise irritation levels as high as misplacing the tool you need (or the one you just laid down) in the clutter on your bench. And stumbling over scraps on the floor as you search just makes matters worse. Everything you need to know about keeping your work area efficient stems from lessons your mom taught.

- Clear scraps, chips, and sawdust off your workbench and tool tables often.
- Toss trash into a can, not on the floor.
- Put away tools you've finished using.
- Set machined parts aside so you won't mistake them for raw stock or scraps.

This uncluttered workbench allows plenty of space for a panel glue-up. A tidy work area is especially important in a smaller shop.



SHOPTIP 122

Round up safety gear

Safety equipment only protects you if you use it, and you're more likely to use it if it's easy to find. So keep your personal protective equipment in a designated, visible, and easy-to-access place, perhaps near the entrance to your shop. Keep a selection of pushsticks, pushblocks, and featherboards near each machine, where they're needed regularly.

Make safety a part of your setup routine. Before you start a machine,

position featherboards, locate pushsticks, put in earplugs, don your safety glasses, and if necessary, find a snug-fitting dust mask or respirator. Then check everything one last time before making the final cut.

Accessories such as this pushstick and featherboard contribute to accuracy and efficiency, as well as safety.



SHOPTIP 123

Start with blue-chip stock

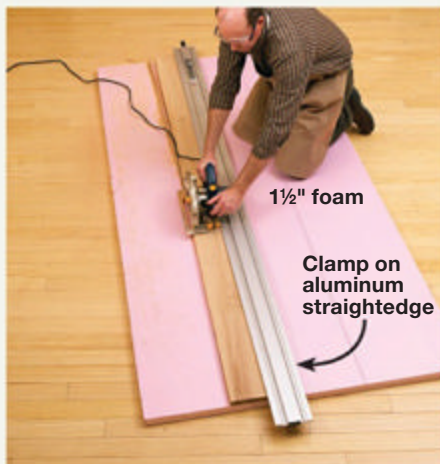
Joint, plane, and saw stock true and square as you start laying out and cutting parts. Measure to make sure boards that are supposed to be the same thickness

really are, and plane at one time all stock that will be a particular thickness. When you mill stock, prepare some extra to test tool setups, joinery, and finishes. Stack

prepared stock where it will be safe from damage. See **Resources 2 and 3** on page 109 for more about using a jointer (or substitute) for stock prep.



This board obviously needs work before it's ready to use. Cutting it into shorter lengths minimizes waste.



Begin with one straightedge on every workpiece. Then rip the opposite edge parallel and square the ends.



Jointing is essential for stock preparation. A router fills the bill if you don't have a jointer (see Resource 3 on page 109).

SHOPTIPS 124 & 125

Make your mark

As you make project parts, put identifying marks on them. If you're working from plans, label the parts with the part letters or numbers from the plan; otherwise use a descriptive name. Mark out oversize blanks to show which parts they'll yield. Label blanks to indicate part position and orientation, too. Simple alignment marks can prevent gluing a piece in backward or in the wrong place. Labels like "top edge" or "back" eliminate confusion and simplify assembly.



Label parts for position and orientation as you make them. Chalk-marks wipe off easily and don't mar the surface.



When you glue up several panels, mark each with the time you clamp it so you can keep track of the curing time.

SHOPTIPS 126, 127 & 128

Measure, measure, cut

The oldest saw in woodworking (yeah, we just had to say that) still holds true: Measure twice, cut once. To maximize accuracy in those

measurements, get into habits like these:

- Use the same tape or rule throughout a project for consistency.
- Measure from the same edge or other

reference surface on matching parts.

- Make precise marks with a sharp pencil or, better yet, a marking knife (item no. 46302 about \$7; rockler.com).



Sometimes it's better not to measure. To determine the length of this trim piece, hold it in position and mark the cut precisely.



Instead of laying out repeat measurements, lay them out once on a template or story stick for accurate transfer to the parts.



Make sure your tape or rule sits flush with the edge when measuring. This hook rule proves more accurate than a tape's sliding hook.

SHOPTIPS 129, 130 & 131

Measure, cut, cut, cut...

Carry out repetitive operations—cutting parts to the same dimension, drilling equally spaced holes, or routing rabbets, for instance—more consistently, quickly, and easily with stopblocks and jigs. You can buy commercial jigs that simplify

many operations, but some of the most valuable ones in your shop will be the ones you create yourself for a specific job. Make it a habit to look for situations where a quickly made jig—something as simple as a scrap of wood clamped to a

miter gauge—will save you from repeated measuring and marking. Make permanent jigs for jobs you do often, such as miter-cutting sides for identical frames. Be sure to label the jig so you don't accidentally toss it.



Set a stopblock accurately by measuring from a kerf cut through the miter-gauge extension to the block.



A simple template saves layout time and ensures accuracy for such jobs as drilling screw holes for hardware.



This shop-made jig sets both the angle and length for sanding matching leg bevels, enabling quick and accurate work.

SHOPTIP 132

Get the most from your time

Set up tools, jigs, and equipment for every operation carefully and precisely, lock the adjustments, and test every setup on scrapwood before machining project parts. To avoid repeating setups, rip all same-width parts at once, for instance, instead of resetting the rip fence several times.

When you interrupt a project and leave a setup to use later, write “Don’t Change Setup” on a sheet of paper and stick it on the tool. Also jot down the setup specifications and which part you’re making with it. Take a digital photo of a setup you might reuse, print it, and add notes.



Once you’ve housed a dado stack on your table saw, you can cut a variety of rabbet widths by simply moving the fence.

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SHOPTIP 133

Dry-assemble everything

Before gluing, assemble the parts without glue to ensure correct fit. Give each part a final inspection as you work, and take note of the order of assembly to avoid glue-up goof-ups. Finally, clamp the dry assembly together.

This assembly rehearsal helps you determine which clamps to use and the best order to apply them. It also can help you identify situations where you might need a helper or temporary support. And after undoing the dry-clamped assembly, the clamps are preset for the real job, further minimizing any glue-up panic.



Dry-assembly before gluing this project revealed the need for a temporary cleat to support one end of the shelf.

SHOPTIP 134

Don’t settle for dull

The importance of sharp tools almost goes without saying. To make clean, accurate cuts, you need sharp tools.

Carbide-tip saw blades and bits stay sharp longer than steel ones, but except for touching up router bits, you can’t

sharpen them yourself. When they need sharpening, let a professional do it.

You can sharpen most hand tools, such as chisels and planes, yourself. Hardened teeth on today’s handsaws and pull saws require grinding, another job for a pro sharpener. Some pull saws and Japanese handsaws feature replaceable blades; it’s often cheaper to replace the blade than to have it sharpened.



Touch-up router bits between sharpenings by honing the flat back of each cutter blade with a diamond file.



You can sharpen chisels and plane irons on a wheel (left) or flat stone (right). Always use a guide to maintain the correct bevel. Sharpening on a wheel results in a hollow-ground edge.



8 tips to square corners

Before building projects with truly square corners you're proud of, you need the proper tools and setups. Use these tips in the shop to get it right the first time.



SHOPTIPS 135–139

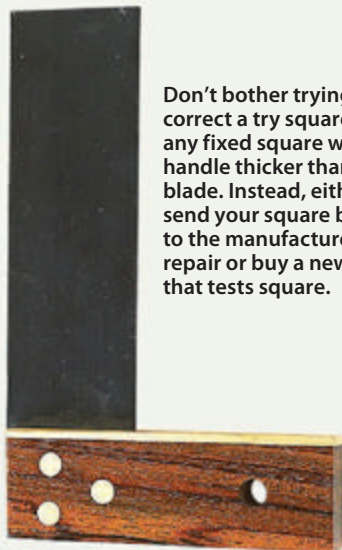
Square projects start with dead-on-accurate tools

In your shop, squares must be absolutely square, measuring instruments must be accurate, and power tools must be set to machine precisely. But precise tools by themselves don't guarantee square assemblies; good technique plays a role, too. To earn the ropes, we went to craftsman Ben Svec, owner of Falls Millwork in Kelley, Iowa. Ben has more than three decades under his belt as a professional woodworker.

Ben learned from experience how to avoid the frustrations of unsquare corners. "Your work is only going to be as accurate as the tools you use," he says. "Once machines are set up square, then you don't have to spend a lot of effort trying to compensate all the way through a project for a joint that's not square."

Ben offers the following tool tips to improve accuracy.

● **Not all squares are reliable.** Never trust any tool right out of the box. Even minor bumps or dings during packaging or shipping could alter the tool's accuracy. Always check it and set it up with squares, rules, and calipers that you know to be accurate.



Don't bother trying to correct a try square, or any fixed square with a handle thicker than its blade. Instead, either send your square back to the manufacturer for repair or buy a new one that tests square.

● **Drafting squares are invaluable.** Use drafting squares—which prove reliably accurate—to check your woodworking squares, as shown in **Photo A**. You might be surprised to discover that your square's not truly square. See **Drawings 1** and **2** for methods to check flat squares and, if necessary, correct your framing square.

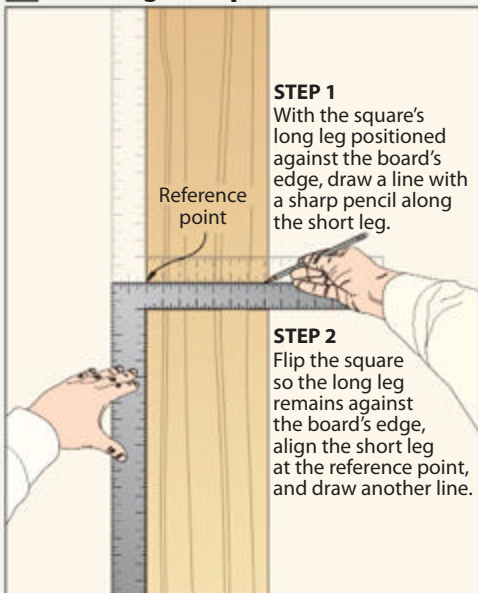


A Keep several plastic drafting squares, including a 12" model for maximum surface contact, in your shop to check tools.



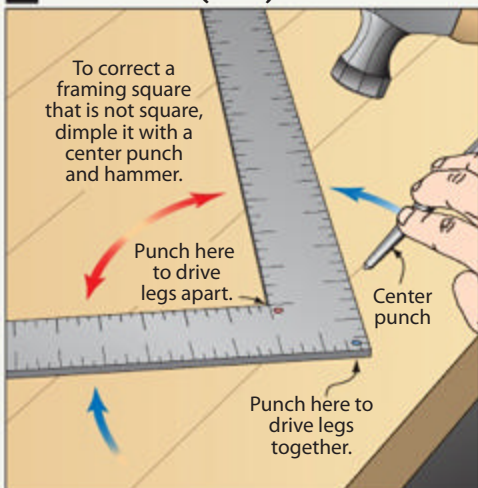
B

1 Checking for square



Check your square's accuracy by comparing drawn lines made from opposing sides of the same reference point.

2 Punch it out (or in)



Correct any flat square by laying it on a flat surface and striking its intersection with a hammer and center punch.

Rely on an accurate steel rule to check your measuring tape. This tape measured $\frac{1}{32}$ " longer than the rule at the 12" mark.

● **Find an accurate standard.** Use a steel rule for measurements whenever possible. The rule lies flat, and most have markings in four different increments ($\frac{1}{8}$ ", $\frac{1}{16}$ ", $\frac{1}{32}$ ", and $\frac{1}{64}$ ") for increasing precision. How do you know your steel rule is accurate? For starters, don't skimp on this tool. Buy a 12" steel rule from a trusted company (Starrett or Incra, for example) known for accurate tools, and use that as your benchmark with which to check all other measuring tools. Or, buy an architect's scale at an art or drafting supply store and use that to check all your rules.

● **Take best shop tools to the store.** Take your drafting square and accurate steel rule to the store and check new squares and measuring tapes for accuracy before buying. To test the tape for outside measurements, hook it on the end of your steel rule and compare the two at the 12" mark, as shown in **Photo B**. For inside accuracy, just push the front of the hook against a rigid surface and do the same with the rule, holding it alongside the tape.

● **Check blade squareness.** With an accurate square, adjust your tablesaw blade so it cuts perpendicular to your tabletop. To do this, Ben removes the throat plate, raises the blade to full height, and positions his square for maximum contact with the table surface, as shown in **Photo C**.

● **Find 90°.** Regardless of what tool you use for crosscutting (mitersaw, radial-arm saw, or sliding table on a tablesaw), the blade and fence must be exactly 90° to each other. Ben does all his crosscutting with his radial-arm saw. Although he never moves it from 90°, Ben still checks it regularly, as shown in **Photo D**. He squares it to the table vertically and horizontally, both at the fence and at its farthest reach.



C

Check the blade's squareness from the side with the narrowest throat opening. Place the square against the blade's body, not its teeth.



D

With the saw unplugged and the blade guard removed, check your saw for square. Never use the saw with the guard off.

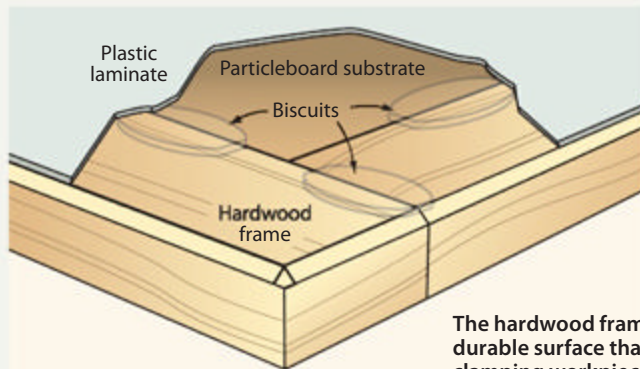
SHOPTIP 140

A large, flat assembly table can be your best tool

To assemble and clamp your projects square, you need a reliably flat surface to work on, as shown at *right*. This assembly table might be separate from your workbench, which can take abuse from tools and accessories. Ben built his assembly table from a 4x8' sheet of 1½" particleboard, edged with 2"-wide hardwood attached with #20 biscuits, as shown in the drawing *below*. He then glued plastic laminate to the top because it resists finishes and glue better than a porous wood surface.

"For putting together cabinets, a flat assembly surface is crucial," Ben says. "Otherwise, it's hard to get your cabinet square." Having a flat surface also allows you to clamp a glue-up to the table, enabling three-dimensional squaring.

Another tip: Apply a sealer finish such as polyurethane to all wood surfaces, including the top's underside, to resist moisture absorption that can cause your table's flat surface to warp over time.



The hardwood frame provides a more rigid, durable surface than the particleboard for clamping workpieces to the table.



A long straightedge reveals any low areas on your assembly table. Shim the top from below if gaps exceed ⅛".

SHOPTIP 141

Measuring diagonals still gets the job done

Admittedly an old standard in woodworking, comparing the diagonal dimensions of a rectangular case continues to be a reliable method for squaring projects—provided opposing sides have been cut to the same length. Don't rely on a framing square to check corners, however; you can get an inaccurate reading because the assembly clamps can bow the sides slightly. (This bow will revert once you remove the clamps.)

To check diagonals, glue and clamp your assembly as needed. Then, using a measuring tape, compare the diagonal measurements across opposing corners. Hook the tape onto the outside corner and read the measurement from the outside of the corner nearest you. Your project is square if the measurements are equal. If they're not equal, correct them by clamping across the longer diagonal, as shown at *right*. Measure from the inside of the corners if your clamp is in the way. Determine the midpoint between the two measurements, and tighten the clamp until both read the same. 🛠️



You've squared the case when the diagonal measurements read the same. Attach the back panel to help hold the case square.

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